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THE MARSUPIAL GENUS *PHALANGER*

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Since the preparation of a first report on marsupials of New Guinea by Tate and Archbold (1937), much additional material, the fruits of the second and third Archbold New Guinea Expeditions, has come into the American Museum of Natural History. The collections of phalangers, thus markedly increased, provide such a quantity of new evidence relating to the genus *Phalanger* that an additional report is warranted. Mr. Richard Archbold is to be congratulated upon having assembled one of the largest collections of phalangers in the world.

Acknowledgment is gratefully made to

the curators of mammals, Dr. W. H. Os-
good at the Chicago Natural History Mu-
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studied. It is a pleasure also to write of
the courtesy and cooperation of authorities
at the natural history museums at Genoa,
Berlin, Leiden, London, and Paris, where in
1937 studies of material and photographs
of some skulls of types were made.

Color names used in descriptions, if
capitalized, are those of Ridgway (1912).

PHALANGER STORR

The first species of the genus *Phalanger*
was described without technical name by
Valentijn¹ between 1724 and 1726. "Color
of the female as well as of the young said
to be like that of a hare, with a longitudinal
black line along the back; in males, how-
ever, which are always larger than fe-
males [the color] is variable but always
rufescent on the belly and sometimes
clear. . . . Among the white ones some ap-
pear to have the throat yellow; the eyes
red in adults." The foregoing is quoted
from Pallas (1766), who also alluded to
Buffon's (1765) description of "le Phal-

anger," and named Valentijn's animal
"*Didelphis orientalis*" (p. 59) or "*Didelphis*
opossum varietas orientalis" (p. 62).

The use of *Phalanger* in the generic
sense began with Storr (1780), who pointed
out its relationship to *Didelphis* and as-
sociated with it the species *D. orientalis*
Pallas. Thus by monotypy *orientalis* is
the type species of *Phalanger*.

The second species to be made known
was the very distinct *P. maculatus*, by
Geoffroy St. Hilaire (1803). Additional
species and races have since been added to
the genus.

Didelphis molucca Kerr (1792), a name

¹ Original not available for consultation.

proposed subsequently to *orientalis* Pallas but before *maculatus* Geoffroy, was accompanied by a description of a South American "four-eyed opossum." Reference was made to Brisson's work (1762), where allusion was made to *Philander orientalis* Seba (1734), *Philander amboinensis* (with spots above the eyes) "from Amboina," and *Philander maximus orientalis* Seba. As Brisson's names for species are not accepted in zoology, and as Kerr's *molucca* plainly referred to an American, not an East Indian, genus (*Metachirus* or *Metachirops*), the name *molucca* is considered to have no relationship to the genus *Phalanger*.

Synopses, discussions, or revisions of importance were published by Waterhouse, 1846, Gray, 1861, Jentink, 1885, Thomas, 1888, Schwarz, 1934, Tate and Archbold, 1937.

When dealing with characters involving age and degree of development in individual specimens of certain species of phalangers, the following standards and terminology have been followed:

- Stage 1 Eruption of molars advanced to m¹ (pouch young)
- Stage 2 Eruption of molars advanced to m²
- Stage 3 Eruption of molars advanced to m³
- Stage 4 Eruption of molars advanced to m⁴
- Stage 5 m⁴ showing pronounced wear

In the parts of this paper devoted to notes on growth, these stages are correlated as far as possible with the development of color and pattern in the pelage, particularly in *P. maculatus*.

Three main groups of species are recognized within the genus *Phalanger*: the *orientalis* group, the *maculatus* group, and the *ursinus* group. The former *celebensis* group is merged with the *orientalis* group.

The *orientalis* group is the most generalized, though it includes a few slightly specialized members, and it has the widest

distribution. Among its characteristics are weak sexual dichromatism in some races; development of pure white individuals in the male sex only; invariable lack of lateral expansion of the anterior nares; total lack of frontal "bulge" in skull; rarely, a diastema between i³ and c (the species *celebensis* only). The total range of the group extends from Celebes and Timor, through New Guinea, to the remotest Solomons and northern Queensland.

The *maculatus* group is specialized in several ways: the males, unless white, have a definite spotted pattern (also weakly present in the race *ornatus* of the *orientalis* group), while, except on islands off the northwest coast of New Guinea, the females lack such spotting; pure white individuals occur in both sexes in the races *P. m. maculatus* and in females, at least, in *P. m. krämeri*, and the young go through a series of color changes; unexpanded anterior nares; unreduced i³ approximated to canine; a pronounced frontal "bulge" in adults of both sexes. The range of the *maculatus* group includes Saleyer, Ceram and the southern Moluccas, New Guinea, north Queensland, the Bismarcks, the Admiralty Islands. It excludes Celebes and the Solomon Islands.

The *ursinus* group is also specialized, although in other ways: no color variations appear between the sexes or the young; white individuals are unknown; the anterior nares in adulthood become greatly expanded laterally; i³ becomes exceptionally enlarged—in one race it is bicuspid; the canine is much reduced in proportional size; broadening of the frontal region may occur in age but there is no true frontal "bulge" as in the *maculatus* group. The range is restricted to the Celebes and Talaut.

FOUR NEW PHALANGERS

Phalanger orientalis peninsulae, new subspecies

TYPE: A.M.N.H. No. 108905, adult male; a skin with skull, in fair condition; Rocky Scrub, 30 miles north of Coen,

north Queensland; collector, G. Neuhauser; field No. 509; June 26, 1938.

GENERAL CHARACTERS: Superficially resembles male specimens of *P. o. brevinasus* but is readily distinguished by much

smaller teeth, which are as small as those of *P. o. microdon*, the adult male of which, though still unknown (but compare females), is thought equal to *mimicus*.

DESCRIPTION OF TYPE: General color light grayish brown, the bases of the hairs whitish, the rump and legs paler, approximately Drab. Dorsal line from between ears to lumbar region fuscous. Underparts dirty white. Skull with general characters of the other races of *orientalis* but skull and teeth considerably smaller.

MEASUREMENTS: Head and body (measured in field), 450 mm.; tail, 345; hind foot, "54"; ear, "37"; skull (measured in laboratory), condylobasal length, 81; zygomatic width, 50; mastoid width, 46; interorbital width, 15.2; width of braincase, 30; length of nasals, 32; greatest breadth of nasals, 15.2; outer width across paroccipital processes, 28.4; palatal length, 45; canine to m^4 , 38.4; crown width of incisors: i^1 , 2.4; i^2 , 3; i^3 , 1.1; p^4-m^4 , 22.6; crown lengths and breadths: p^4 , 4.7 by 3.9; m^1 , 4.9 by 3.9; m^2 , 4.4 by 4.2; m^3 , 4.7 by 4.1; m^4 , 4.4 by 4.

REMARKS: In the lower jaw four minute obsolescent teeth appear between the chisel-shaped incisor and p_4 . An anomaly shows in the left upper jaw; the milk p^4 is retained between the permanent p^4 and m^1 . Dental measurements were made on the right toothrow.

PARATYPE: A second specimen, adult female, A.M.N.H. No. 108904, taken June 24, 1938, is distinguished from the male by its uniformity of dorsal color, which is much darker, near Benzo Brown, and has the white of the underparts restricted to the region anterior to the pouch. The belly hairs behind the pouch are also Benzo Brown. The hairs in both specimens are grizzled with whitish. This adult female is colored in marked contrast to those of *P. o. microdon* from south New Guinea, just across the Torres Strait. The latter are much redder "near Sayal Brown or Ochraceous Tawny." The white spot behind the ear seen in New Guinea material is undeveloped in either Australian specimen.

REMARKS: This race seems to show the closest affinities with *microdon* (= *mimicus*)

and with some of the island forms from northeast of New Guinea.

***Phalanger celebensis pelengensis*, new subspecies**

TYPE: A.M.N.H. No. 107997, adult male; a skin with skull, both in good condition; Peleng Island, Celebes; collector, J. J. Menden; July 25, 1938.

GENERAL CHARACTERS: A very small race of *Phalanger*, closely resembling *P. celebensis*, but clear tawny brown instead of brownish gray, and with under parts yellow instead of white; resembles *P. c. rothschildi* in color and size but lacks the middorsal line.

DESCRIPTION OF SKIN: Hairs of back, head, flanks, base of tail, limbs, hands, and feet colored Sayal Brown, their normally concealed bases almost white. Throat and underside of neck near Cinnamon Buff; ventral parts Naples Yellow. No trace of dark dorsal stripe.

DESCRIPTION OF SKULL: Skull agrees closely with those of *celebensis* and *rothschildi* in most particulars. It is of approximately the same size and agrees closely in arrangement of the upper incisors and canines, i^3 being small and very slender with its root in virtual contact with that of c . It differs from *celebensis* only by the pointed (instead of rounded) form of the mastoid region, which last agrees substantially with the same structure in *P. c. rothschildi* and *P. orientalis*. The very minute third upper premolar, or its alveolus, can be perceived in all specimens. In the lower jaw there are three minute teeth between the big incisors and p_4 .

MEASUREMENTS: Head and body,¹ 364 mm.; tail,¹ 266; hind foot,¹ 47; skull, condylobasal length, 66.5; zygomatic width, 42; palatal length, 36; length of nasals, 25; greatest width of nasals, 9; interorbital width of temporal ridges, 10.5; mastoid width, 33; p^4-m^4 , 19; crown length of i^2 , 3; of i^3 , 1.5; p^4 , 3.8 by 3.3; m^1 , 4.5 by 4; m^4 , 3.5 by 3.3.

REMARKS: Besides the type, the collector procured six males and seven females from the same locality.

¹ Measured by the collector.

The race *pelengensis* is most nearly like *rothschildi* from Obi.

***Phalanger atrimaculatus*, new species**

TYPE: A.M.N.H. No. 151813, adult male; a flat skin with skull, in good condition; Bernhard Camp, Idenburg River, 100 miles southwest of Hollandia, Netherlands New Guinea, 75 meters; collector, W. B. Richardson; May 5, 1939.

DESCRIPTION OF SKIN: Basal coloration a dull golden brown, near Chamois and Cinnamon Buff, dorsally and ventrally. Top of head, ears, neck, withers, and outside of forelimbs bright rufescent, near Tawny and Hay's Russet, becoming more saturate on hands and feet. Middle and hind back closely spotted with jet black—not chocolate or brownish black—which extends onto the thighs. Old (age stage 5, or with m^4 well worn).

DESCRIPTION OF SKULL: Very large, heavily ossified, and with exceptionally deep malar arch. Distinguished from the various races of *maculatus* by the extreme narrowing of the external pterygoid wings, the great broadening of the palate at the level of p^4 , the fact that the masseteric ridge remains low on the jugal arch, and the presence of a small m^3 .

MEASUREMENTS: Skin (in the field), total length, 1204 mm.; tail, 610; hind foot (s.u.), 75; ear from crown, 27; skull, condylobasal length, 107 mm.; zygomatic breadth, 74; palatal length, 62; mastoid width, 60; outer width across p^4 - a , 39; toothrow, length, c - m^4 , 56.5; p^4 - m^4 , 37; p^4 , 7.6 by 6.3; m^4 , 6.8 by 5; mandible, front of incisive alveolus to articular process, 89.

REMARKS: *Phalanger atrimaculatus* is based upon the type and a second male, A.M.N.H. No. 79807, virtually identical in every respect except that it was collected at Keku, south of Madang, approximately 500 miles east of the type locality. This new spotted phalanger is here treated as a full species, partly because of seemingly valid anatomical peculiarities and partly because both known localities are in the

heart of the distributional range of *P. m. maculatus*. It is, of course, possible that *maculatus* and *atrimaculatus* occupy separate ecological niches in the same areas and can thus be considered racially distinct, but such is hard to picture in the case of scendent forest animals like *Phalanger*.

***Phalanger ursinus togianus*, new subspecies**

TYPE: A.M.N.H. No. 153377, young adult male; a flat skin with skull, in good condition; Malenge, Togian Islands; Gulf of Tomini, Celebes; collector, J. J. Mendon; December 17, 1939.

GENERAL CHARACTERS: Externally very like *ursinus*. Distinguished by the unusual enlargement and bifid crown of the third upper incisor.

DESCRIPTION OF SKIN: Bases of hairs fuscous; tips tinted strongly with a golden brown overwash most pronounced about the face and sides of neck, fading to straw color on rump and sides of tail. Underparts grayish white with hair bases fuscous. Ears brown.

Skull with the characteristics of *ursinus* and *furvus* but with i^3 modified as stated above. The posterior one-third of the crown is separated as a distinct pointed cusp, by vertical grooves on the internal and external faces of the tooth.

MEASUREMENTS: Head and body, 564 mm.; tail, 542; hind foot, 104; skull, condylobasal length, 93; zygomatic width, 60.5; interorbital width, 21; mastoid width, 46; length of nasals, 34; greatest width across nasals, 18.3; palatal length, 49; p^4 - m^4 , 31; p^4 , 6.2 by 5.1; m^1 , 6.7 by 5.4; m^4 , 5.5 by 4.8.

REMARKS: The tooth character used to distinguish the Togian Islands race is present in 10 out of the 12 males but in only five of the 11 females of the series. Thus there remains a minority of specimens which cannot be distinguished from typical *ursinus*. No sign of such division of i^3 is discernible in any of our 27 specimens from the mainland.

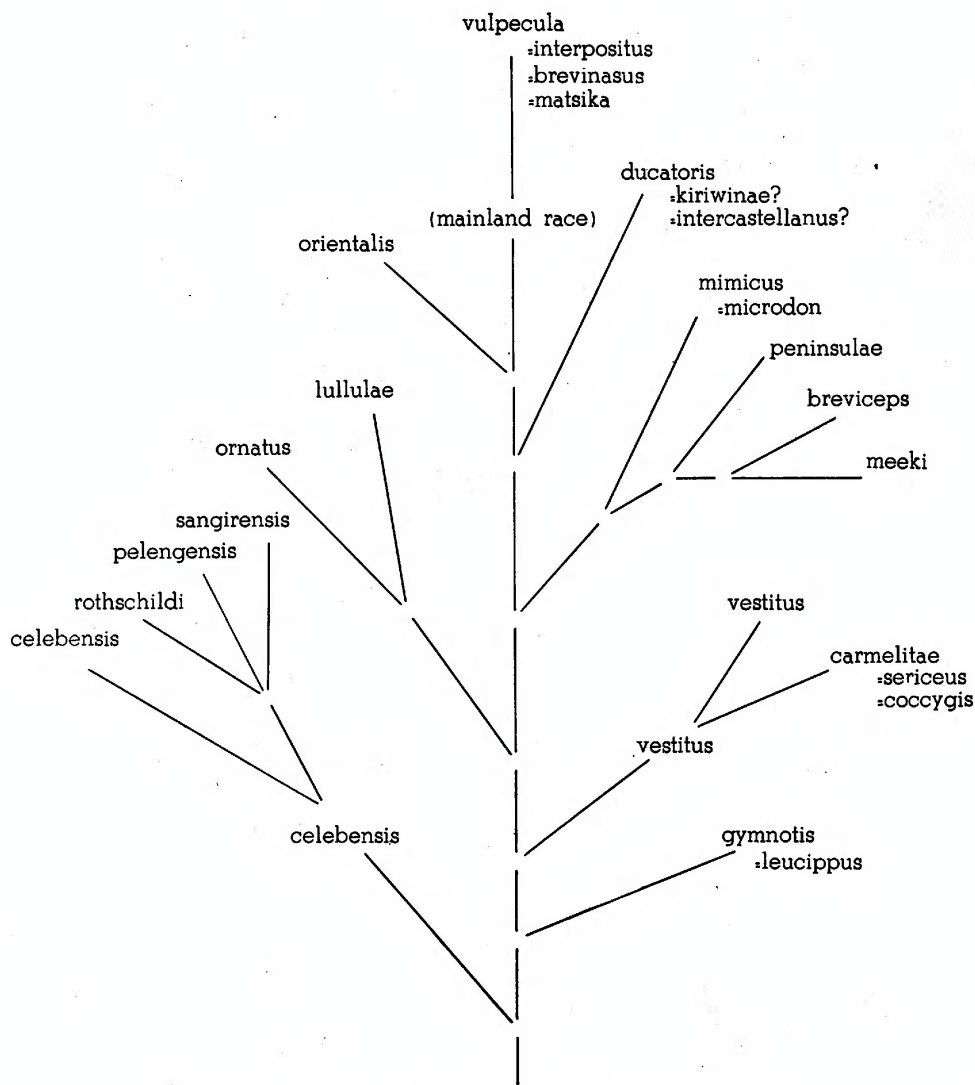


Fig. 1. Phylogenetic tree of the *Phalanger orientalis* group.

PHALANGER ORIENTALIS GROUP

The *Phalanger orientalis* group is here reclassified in the following manner:

1. *orientalis*
 - a. From Amboina and Ceram, true *orientalis*
 - b. From Moluccas, *ornatus* = ?*cavifrons* = ?*macrourus*
 - c. Continental, eastern and Australian races
2. *gymnotis*, large-toothed species
 - d. Mainland race, *leucippus*
 - e. The questionably separable Aru Island race, *gymnotis*

- f. Wetar Island race showing kinship to true *orientalis*; probably the same as on Timor
3. *vestitus*, silky phalangers, with several ill-defined races
4. *celebensis*, least phalangers and races, found on Celebes, Peleng, Obi, and Sanghir

Phalanger orientalis is distinguished from the three other members of the group chiefly by the lack of the features which characterize them. On the positive side,

most of its races exhibit some degree of sexual dichromatism (gray males, brown females); the juvenals are usually reddish; white males appear only in this species (the races *P. o. orientalis* and *P. o. ducatoris*); the race *P. o. ornatus* is often spotted; p_4^4 are not exceptionally enlarged, as in *gymnotis*; *c* is never so reduced nor is the skull so small as in *celebensis*; the hair never attains the long, lax condition of *vestitus*. The range of the species is shown in figure 8.

olate brown forms of the New Guinea mainland.

Phalanger celebensis comprises several races of very small animals in which, though the sexes are colored alike, the young are usually reddish. In all, i^3 is distinctly separated from *c*.

Phalanger orientalis

The classification of the phalangers of this species is the most complex of all. It

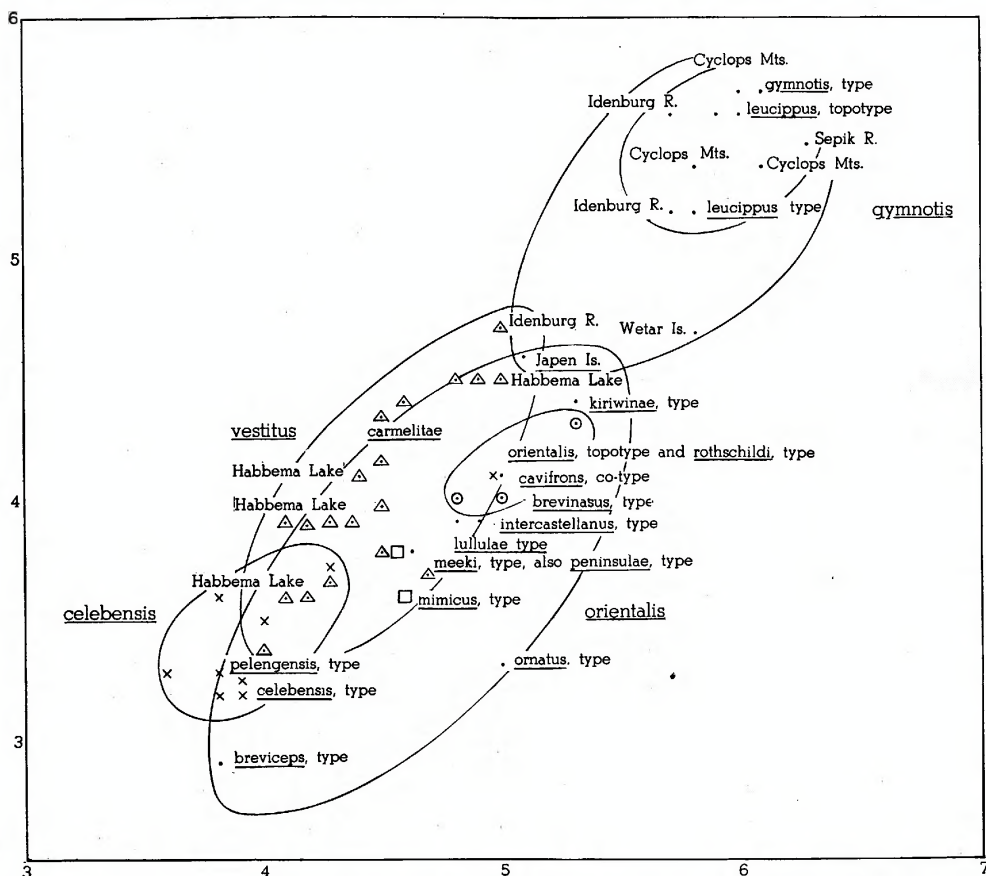


Fig. 2. The crown dimensions (in mm.) of p_4^4 in males of *P. orientalis* and close allies. Vertical represents width of tooth; horizontal, its length.

Phalanger gymnotis is a large, strong species totally devoid of color distinction between the sexes or the adults and young; p_4^4 are exceptionally large and considerably displaced outward from the toothrow.

Phalanger vestitus, the mountain phalanger, includes the silky, long-haired, choc-

appears that the mainland of New Guinea contains two relatively homogeneous races of the species: *vulpecula* = ?*interpositus* = *brevinasus* = *matsika*, a large-toothed form occupying most of New Guinea with the exception of southern New Guinea (including the basins of the Fly and Digul

and races of the *P. orientalis* group, as well as the very slight differences between the sexes, are strikingly illustrated by plotting the crown dimensions of the last upper premolar (figs. 2 and 3). The relatively large size of that tooth in *P. gymnotis* and its very small size in *celebensis* and the peculiar *P. o. breviceps* (type specimen) are emphasized, as well as the generally broader, shorter form of the tooth in *vestitus* when compared with the races of *orientalis*.

In the same way, absolute and proportional differences in the hinder part of the skull in the several species are demonstrated by the ratio graphed in figure 4. In this instance the difference of proportion is most noticeable between *orientalis* and *gymnotis*; in *celebensis* it is set off sharply from *orientalis* by size only.

Owing to the limited number of specimens available for plotting in figures 2 and 4, the lines drawn to enclose the races and species assume only sub-elliptical outlines. Were ideally large numbers of specimens available, nearly perfect ellipses would be drawn to enclose them; the long axes would represent norms and the lateral expanses, standard deviations from the norms.

The positions of many of the type specimens of species and races in relation to the whole picture are indicated in the diagrams. The geographical names indicate other specimens from the places named, which may be hundreds of miles from the type localities. The distinctions brought out in these diagrams are founded upon size and structure. Only incidentally, as in the cases of *P. celebensis* and *gymnotis*, is distributional significance shown also.

The symbols used in figures 2-4 are alike:

Dots	<i>P. gymnotis</i> , with <i>leucippus</i> ; also anomalous material from Wetar Island, and members of the races of <i>P. o. ornatus</i> and <i>P. o. breviceps</i>
Dots in circles	Mainland <i>P. orientalis</i> of the race <i>vulpecula</i>
Squares	The south New Guinea race, <i>P. o. mimicus</i> , with <i>microdon</i> , and the allied race of <i>peninsulæ</i>
Dots in triangles	<i>P. vestitus</i> , with <i>carmelitæ</i> and <i>coccygis</i>
Crosses	<i>P. celebensis</i> and relatives

The lesser ellipsoid containing circles, within the greater ellipsoid which represents *P. orientalis*, full species, typifies the form *vulpecula* on the New Guinea mainland north of the Central Range.

Shift of the long axes out of the same straight line may be taken to mean different proportions in the structures plotted.

Phalanger orientalis orientalis (Pallas)

Didelphis orientalis PALLAS, 1766, *Miscellanea zoologica*, p. 61.

? *Didelphis quoy* GAIMARD, 1824, *Bull. Sci. Nat.*, Paris, vol. 1, p. 271; QUOY AND GAIMARD, *Voyage Uranie*, Zool., p. 58.

? *Cuscus amboinensis* LACÉPÈDE, 1801, *Mem. Inst. Paris*, vol. 3, p. 491.

Establishment of the identity of true *orientalis* is of great importance in work on the systematics of the group. Pallas (1766) applied the name *orientalis* to the animal from Amboina described by Valentijn (1724-1726), so the striped phalangers from Amboina are without much doubt referable to true *orientalis*. Although no actual specimen of true *orientalis* is contained in our collection, a photograph of the skull of an old albinistic male, B.M. No. 83.3.24.7, from Amboina, provides evidence of the skull characters of the typical race. In it the frontal trough is singularly broad and deep (the greatest breadth, 21 mm.), and the supratemporal ridges come abruptly together behind to form a pronounced sagittal crest. The zygomata are well broadened, exceeding the mastoid breadth (68/53). The nasals are relatively short, not sharply pointed anteriorly. The fourth premolars are not enlarged and are but little twisted, or displaced outwards from the row. The crown widths of the upper incisors are: i^1 , 2.6 mm.; i^2 , 2.7; i^3 , 1.1. These dimensions require interpretation: i^1 , a chisel-like incisor growing from a consistent pulp, becomes heavier and thicker as the animal ages; i^2 , on the other hand,

begins as a rounded (in section), chisel-like crown carried on a relatively slender permanent root. Thus, as the crown is worn down to the root the tooth becomes smaller in section. So, when animals are young,

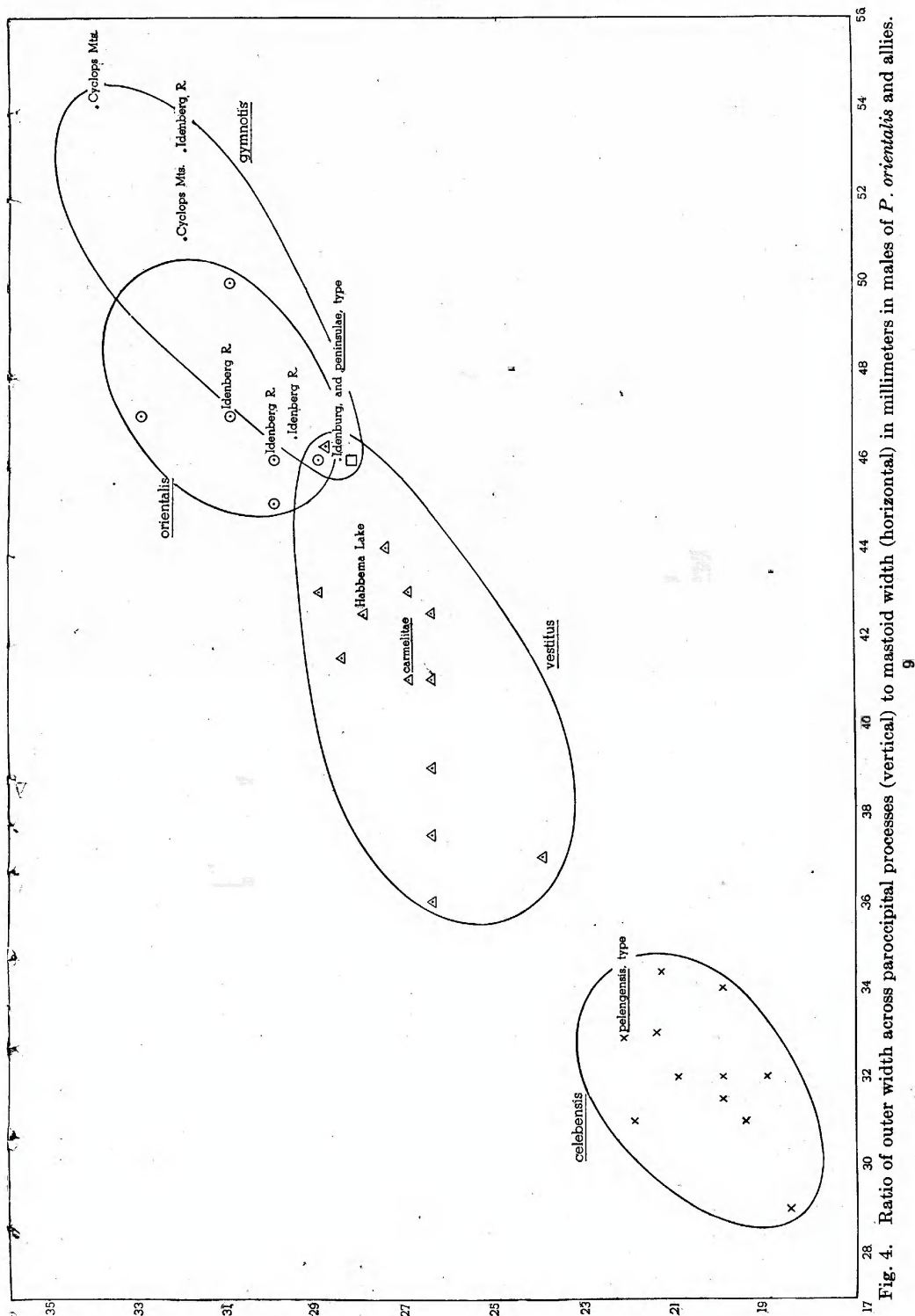


Fig. 4. Ratio of outer width across paroccipital processes (vertical) to mastoid width (horizontal) in millimeters in males of *P. orientalis* and allies.

the width of i^1 may be less than that of i^2 ; when old, the reverse is often seen.

Jentink (1885, pp. 100-104) dealt almost wholly with specimens from the general neighborhood of the Moluccas. He pointed out the fact of partial or total obsolescence of the longitudinal dorsal line in some animals. The "brown" color mentioned by him may well be due to fading of an original gray.

Of the specimens described by Jentink from Amboina and Ceram (I take them together) most males were white and most females were "brown." One female was "reddish brown." Among the white males one had a "brown collar" and one showed a trace of the dorsal line. Many others were juvenals which showed "brownish silvery" or gray body color. The dimensions of none were given. To summarize, we may consider that in typical *orientalis* adults nearly all the males are white or grayish white and the females are either gray or gray brown.

Specimens described from Buru and Sula Besi, west of Ceram, seem to agree with the form from Ceram. White males occur. The same is true of specimens from Goram, east of Ceram.

It is my opinion that *Phalanger quoyi*, with well-defined dorsal stripe, is a member of the *orientalis* group, not of the *maculatus* group, in which it has been synonymized by authors. The mounted specimen, Paris No. 209, with skull in the skin, probably a female, is marked as from Waigeu (Gaimard, 1824, p. 271, states that it was said to be from Amboina, but Quoy and Gaimard, 1824, p. 59, pl. 6, state that it was from Waigeu). The present color (1937) of the skin is faded gray brown; underparts buffy; a slightly reddish area behind the eye; the whitish of the underparts comes up to a line joining the angle of the mouth with the ear. Head and body, 400 mm.; tail, 310; hind foot (s.u.), 52. Widths of incisor crowns, i^1 , 2 mm.; i^2 , 3.1; i^3 , 1.7.

The plate in Quoy and Gaimard (1824) depicts a tawny-colored animal with small spots of slightly deeper brown. These do not show at all in the type today. Whether the specimen is referable to true *orientalis* or to the race *ornatus* is still uncertain.

Measurements of *P. orientalis* are shown in table 1.

Phalanger orientalis ornatus (Gray)

? *Phalanger macrourus* LESSON AND GARNOT, 1826, Voyage Coquille, p. 156.

? *Phalangista cavifrons* TEMMINCK, 1827, Mammalogie, vol. 1, p. 17.

Cuscus ornatus GRAY, 1860, Proc. Zool. Soc. London, p. 1.

Phalanger ornatus was held by Jentink to be fully synonymous with *orientalis* of Amboina and Ceram. But certain obvious differences between the two can be noted. In *ornatus*, albinistic males, so usual in populations of *orientalis*, either do not occur or must be rare. Again, spotting on the brownish gray or buffy brown basal coat color, common in *ornatus*, is unknown in true *orientalis*, except the race *lullulae*. Finally, the skull of *ornatus* differs from that of *orientalis* by the pinched-in muzzle and by several other features, shown beyond.

The type specimen, an adult male, B.M. No. 60.1.10.17 (skull, B.M. No. 60.1.10.18) was collected by A. R. Wallace at Batjan Island. A photograph of the skull shows considerable enlargement of both i^1 and i^2 , their crown widths, respectively, 2.2 and 3.2 mm., indicating greater massiveness of both teeth than is the case in true *orientalis*. Furthermore, the frontal trough is carried much farther back between the temporal ridges, and the nasals, pointed in front, extend to the back of the premaxillae.

In a very old specimen (M.C.Z. No. 7000), female (to judge from the lack of heavy scales beneath the proximal end of the bare part of the tail), from Galela, Halmahera, the cranial characters of the type are substantially reproduced. Of the upper incisors, i^1 is worn down almost to its root (width only 2.5 mm.). In both specimens the minute p^3 is present. The skin appears faded; its general dorsal color approaches Raw Sienna, relieved by a slightly darker dorsal line and a few scattered paler spots. The Raw Sienna fades to Cream Buff on rump and thighs. Color of underparts white.

A third specimen of *ornatus* examined, Genoa C.E. No. 10315, female, also from Halmahera, is slightly more reddish than

the foregoing. The crown widths of the incisors are: i^1 , 1.9; i^2 , 3.1, indicating greater youth.

Phalanger macrourus Lesson and Garnot was described "... body gray with scattered brown spots ... female ... the large-tailed cuscus is only 12 inches 8 lines from nose to base of tail, and this has 17 inches ... covered with a dense pelage, exceeded by many silky black hairs. . . instead of three false molars there are but two. . . ears more prominent. . . equally haired inside and out. . . hair of ears white, also the throat and underside of neck. . . belly and inside of thighs whitish." This description is accompanied by a badly colored plate in which the tail is drawn disproportionately thick. *P. macrourus* was formerly placed in the synonymy of *P. maculatus*.

Phalanger cavifrons Temminck, from "Moluccas," is today represented in the Leiden Museum by a skull only (Cat. No. M-3). The mandible associated with the skull does not belong to it. The skull is juvenal, with m^2 newly erupted. It may be referable either to *orientalis* or *ornatus*, or it may be from the New Guinea mainland (which was once loosely included in "the Moluccas").

The *ornatus*-like phalangers are mentioned specifically from Halmahera, Batjan, Ternate, and Morotai.

Phalanger orientalis vulpecula (Förster)

Pseudochirus vulpecula FÖRSTER, 1911, Zool. Ann., ser. 2, vol. 42, p. 179.

Phalanger orientalis interpositus STEIN, 1933, Zeitsber. f. Säugetierk., vol. 8, p. 90.

Phalanger brevinasus TATE AND ARCHBOLD, 1935, Amer. Mus. Novitates, no. 810, p. 5 (males).

Phalanger matsika TATE AND ARCHBOLD, 1935, *ibid.*, no. 810, p. 7 (females).

MATERIAL EXAMINED: The original series of *brevinasus* and *matsika*; several more specimens from the type locality, including fully adult females; a series of eight specimens from the neighborhood of the Cyclops Mountains, north coast of New Guinea; several males and one female from the middle Idenburg River; a female paratype of *interpositus*; Stein's material from Japan Island.

The principal characters of *vulpecula* are

the much greater size of males than females; the gray color of the male pelage contrasted with the coppery brown of the fur of the females; and the strongly reddish brown color of juvenal males and females. These characters are probably shared with *mimicus* = *microdon*, of which we have no adult males. *P. o. vulpecula* has decidedly larger teeth than *P. o. microdon*.

Two young seem to be born at a time; each of two females collected near Port Moresby carried two pouch young. The young were much grayer than other juvenals no longer living in the pouch, but nevertheless showed indications of reddish. The pelage was very short, as is usual in pouch young. The blackish dorsal stripe was already evident. One pouch contained a male and a female, the female with proportionately longer tail. The ratio of tail to head and body: female, 228/232; male, 212/237. The type of *matsika* had but one pouch embryo; A.M.N.H. No. 109443 from Sentani Lake had three; the paratype of *interpositus*, Stein's field No. 98, had two. It is possible that this multiparous habit (compare *maculatus*) has some value in classification.

Stein's series from Japan (taken March, 1931) is also sexually dichromatic. Males are gray with white underparts, females brownish gray, underparts gray white. In the young stages the males are gray, the females reddish.

Specimens from Misol, Salawatti, Jobi, and Soek, as well as from Kei, seem to be referable to the New Guinea mainland form.

Phalanger orientalis vulpecula of the Huon Peninsula was described by Förster (1911) as a reddish juvenal (" m^3 not erupted") under the name *Pseudochirus vulpecula*. He wrote of the distinctive *Phalanger* character: "terminal 115 mm. of tail bare." The skull dimensions given were: basal length, 50 mm.; zygomatic breadth, 32 mm. All this indicates *Phalanger* and differs from *Pseudochirus*. Thomas (1922), using the name "*orientalis*" for specimens from the Rawlinson Mountains, wrote about the "well-known red juvenal state." Thus it seems reasonable to conclude that the Huon Peninsula animals, *vulpecula*, and the

widely dispersed *P. o. brevinasus*, whose young also have red pelage, are synonymous.

Measurements appear in table 2.

***Phalanger orientalis mimicus* Thomas**

Phalanger mimicus THOMAS, 1922, Ann. Mag. Nat. Hist., ser. 9, vol. 9, p. 680.

Phalanger microdon TATE AND ARCHBOLD, 1935, Amer. Mus. Novitates, no. 810, p. 8; 1937, Bull. Amer. Mus. Nat. Hist., vol. 73, p. 378.

MATERIAL EXAMINED: The type of *mimicus*; the original series of *microdon* from Dogwa; two juvenal specimens from the Palmer River, upper Fly River. Also Genoa C.E. No. 5401, adult female from the Fly River, collected by D'Alberty, concerning which is written in my notes "skull generally as in *brevinasus* but rather smaller and shorter; the individual teeth much smaller. . . p^4-m^4 , 21 mm.; m^{1-3} , 13.8." (Compare Tate and Archbold, 1937, p. 444.)

In Perth Museum (Western Australia) are two juvenal specimens, M-513, male, and M-514, female, collected by Stalker at Kei. They are small reddish phalangers possibly referable to *microdon*.

Specimens from Aru alluded to by Jentink (1885) are probably referable to *mimicus*, since that island seems to have been connected in the recent past with south New Guinea.

The range of this race is not known to overlap that of *P. o. vulpecula* found north of the main mountain range. *P. o. mimicus*, including *microdon*, inhabits the whole of southern New Guinea from the Torres Strait to the upper Fly River and westward along the narrow coastal strip of Netherlands New Guinea at least as far as the Mimika River. Eastward the limits of its range are not known. At Port Moresby its place is taken by *brevinasus* = *vulpecula*.

***Phalanger orientalis peninsulæ* Tate**

(See description, p. 2.)

***Phalanger orientalis* NORTHEAST OF NEW GUINEA**

Several of these phalangers, often collectively named *P. o. breviceps*, have at

various times been given subspecific names by Thomas:

<i>P. o. intercastellanus</i>	Fergusson Island, D'Entrecasteaux
<i>P. o. meeki</i>	Tegula Island, Louisiades
<i>P. o. lullulæ</i>	Woodlark Island, Trobriands
<i>P. o. kiriwinæ</i>	Kiriwina, Trobriands
<i>P. o. ducatoris</i>	Duke of York Island, Bismarcks
<i>P. o. breviceps</i>	San Cristobal, Solomons

Phalangers of the island groups off the eastern tip of New Guinea may first be considered. Those islands are nearer the mainland, and their comparatively shallow under-water connections are all with New Guinea.

With the exception of *lullulæ* from Woodlark Island, the most remote of the Trobriand group, these races are gray or brownish, there being little difference in color between males and females. The males are generally a little paler gray. The females apparently never develop the reddish brown color usual in the New Guinea race *vulpecula*.

Only three named races are involved: *kiriwinæ* from Kiriwina, western Trobriand Islands; *intercastellanus* from Fergusson Island, D'Entrecasteaux group; and *meeki* from Misima (= St. Aignan) Island, the Louisiades Archipelago. A few years ago, after examining the types of all, I concluded that the large skulls of *intercastellanus* and *kiriwinæ* showed closer relationship to those of the Bismarcks and New Guinea animals, and that the short-faced skull of the smaller *meeki* resembled typical *breviceps* of San Cristobal, the most easterly of the Solomon Islands. Possibly *kiriwinæ*, *intercastellanus*, and *ducatoris* should be synonymized.

The peculiar Woodlark Island race *lullulæ* exhibits analogies with *ornatus* on the Moluccas, west of New Guinea; it is spotted with pale buff on gray. The pelage is short and rather stiff; the ventral color white to the roots. The skull is somewhat pear shaped. Molars small.

We may consider next the phalangers of the Bismarcks and Solomons. The populations of striped phalangers taken successively from Long and Ruk Islands,

through New Britain, New Ireland, the groups of islands north and east of it (Tabar, Lihir, Tanga, and Nissan), and from Bougainville southeast through the twin chains of the Solomons show the following peculiarities:

1. Those of Long Island and Ruk, New Britain, Duke of York, New Ireland, Lihir, and Tabar are large, heavily built animals, the males drab gray, females darker brownish gray, with strong, elongate, narrow skulls, and large teeth. To this group *ducatoris* probably belong the large, broad-skulled phalangers *kiriwinæ* of Kiriwina (Trobriands) and *intercastellanus* of Fergusson (D'Entrecasteaux). If *orientalis* is represented on the Admiralty Islands and St. Matthias it may be expected to conform to this general type.

2. White males occur on Long Island and (?) New Britain; they are analogous to the white males in *P. o. orientalis* of Ceram and Amboina.

3. On Tanga, off New Ireland, and Nissan, between New Ireland and Bougainville, unusually small animals occur, in which the skull is short and broad and the teeth sharply reduced in size. The extreme in this respect in our collection is A.M.N.H. No. 79793, adult female, from Nissan, in which the length of p^4-m^4 is only 19.5 mm.

4. The average body and skull sizes in the population of gray phalangers on Bougainville of the Solomons are larger than those of the Nissan race, though they do not attain that of *ducatoris* of the Bismarcks. The Bougainville race also contains individuals of slightly smaller size, with which the phalanger populations on the remaining islands of the Solomons eastward agree closely.

5. Elongation of the skulls of the race *ducatoris* (fig. 5) is seemingly a function of age. It is associated with great development of the supratemporal, sagittal, and lamboidal crests. Slightly younger adults, though with fully developed dentition, have the skull yet unlengthened, with the ratio, zygomatic breadth : basi-occipital length, from 65 to 67 per cent. In old specimens of either sex that ratio varies from 59 to

62 per cent. The seeming lack of elongation of the skull in adults of the phalangers of the Solomon Islands may either be real and correlated with the smaller teeth, or it may lack significance because of our inadequate age series. It is to be noted that in certain animals from Bougainville, Mono Ganonga, and Malaita, the said ratio may be as low as 60 per cent.

6. On the Solomons, besides gray phalangers, there occur specimens with silky pelage colored blackish brown or chocolate brown. Their skulls and teeth are indistinguishable from those of the gray phalangers. The distribution of these animals through the southern Solomons arc—we have them from Bougainville, Rubiana, Ganonga, Rendova, Guadalcanal, Komanchi, and Malaita—may be only apparently important, as we have but a limited collection of phalangers from the northern arc of islands, none at all from Choiseul or Ysabel, and only one (gray) from Molakobi which lies between them. Whether or not these chocolate-colored animals conform to a geographical pattern of distribution within a part of the Solomons group, they are certainly restricted to those islands when taken together. Their dark color, silky fur, and the sharp defining line between dorsal and ventral color (clear buffy white) offer a striking analogy to the New Guinea mountain-inhabiting phalangers, *P. vestitus* and allies. The teeth, however, are much smaller.

7. The color of juvenal animals from the eastern and northeastern islands is as yet poorly determined. From Bougainville (Buin) comes a juvenal specimen in red pelage that well matches that of young *brevinasus* of New Guinea. From Ganonga we have a late pouch-embryo in the characteristically short coat; its slightly reddish gray color closely matches that of pouch young of *brevinasus*. On the other hand, from the north coast of Bougainville a juvenal individual, apparently the offspring of the chocolate-colored variety, has long, lax, blackish brown fur. A juvenal female of *intercastellanus* from Goodenough Island has the customary red brown coloring of the majority of the races of *orientalis*. Yet an only slightly larger subadult male

	Number of Specimens		Per cent ratio of zygomatic breadth basi-occ. length					Length p - m in mm.									
	Male	Female	Upper lines males, lower lines females					Upper lines males, lower lines females									
			60	62	64	66	68	19	20	21	22	23	24	25			
<u>kiriwinae</u> , type	1																
<u>intercastellanus</u> , type	1						-										
Long I.	5	3															
Ruk I.	1				-								-				
New Britain	4	3															
<u>ducatoris</u> , type	1												-				
Tabar Is.	1	2															
Lihir Is.	1	2															
Tanga Is.		1		-													
Nissan Is.	1	2															
Bougainville		4															
Mono I.	4	3															
Molakobi I.		1															
Ganonga I.	3	3															
Rendova I.		1		-													
Gatukai I.	1	1	-														
Komanchi I.		1	-														
Malaita	2																
<u>breviceps</u> , type	1																

Fig. 5. Comparison of forms of *P. orientalis* on the islands northeast of New Guinea.

of *meeki* from Tagula Island, Louisiades, is already completely gray.

It does not seem possible even yet to draw sound conclusions from the facts about these island forms so far presented. Most appear to be in a formative or transitional stage, which, if they could be bred and watched under laboratory conditions, might be highly instructive.

Phalanger gymnotis (Peters and Doria)

Phalangista gymnotis PETERS AND DORIA, 1875, Ann. Mus. Civ. Genova, vol. 7, p. 543.

Phalanger leucippus THOMAS, 1898, *ibid.*, ser. 2, vol. 19, pp. 7-8.

MATERIAL EXAMINED: Port Moresby area: six (previously reported, from 2000-7000 feet), two (Astrolabe Range); upper Fly River (head waters): one (3000 feet); upper Idenburg River: 10 (200 feet); Cyclops area: five (1-1000 feet); lower Sepik River (borrowed): one (100 feet?).

A further record was made by Jentink in 1911 of one specimen from Ryen Island and two from Alkmaar, up the Noord River.

The total material indicates a vertical range for this conspicuous species between sea level and 7000 feet. It appears to be just as abundant north of the Central Range as south of it, so a generalized pattern of distribution for it is indicated (fig. 9). Its extension to Aru Island may well have been accomplished during the glacial period, when Aru was connected to the mainland somewhere near de Jorg's Point.

The great stability in this species is indicated by the relatively good series from widely dispersed localities. The commonly present "ticked," shining, slightly curled gray pelage is varied in only two specimens (males from Idenburg River) in the direction of a flatter, more neutral gray. The black dorsal line is invariably strongly defined. The underparts vary slightly from light gray to grayish white. There is often a chest patch in which the hairs are white to the roots. In an old female near-topotype (of *leucippus*) considerable chestnut appears on throat and chin (possibly a food stain), reminiscent of the appearance of certain *Rattus* of that region. As table 3 shows, there appears a

slight though not uniform increase in size of m^4 in specimens from the north center of the island, as compared with those from the southeast. The *gymnotis* of Aru falls in with the former. Our one specimen (male) from Mount Karik (3000 feet), head waters of the Fly River, has no skull. Not a single specimen of our series lacks the small p^3 .

Growth stages in *P. gymnotis* cannot be shown; we have but two young specimens, a stage-1 female, with mp_4^4 still in place, and a stage-3 male in which p^4 is fully erupted. A series of measurements of *P. gymnotis* appears in table 3.

The type of *P. gymnotis* is a mounted male skin, Genoa C.E. No. 1545, and mounted skeleton, C.E. No. 3966. Of general size of *leucippus* but the pelage appearing shorter (5-7 mm.). Ears not concealed. The customary heavy scaling is seen in the tail as in *leucippus*. In the skull, great expansion of the zygomata and extreme enlargement of p^4 , coupled with its outward displacement and rotation, are noteworthy. "Rostrum short and massive; maxillo-premaxillary suture reaching nasals at middle; frontal trough deep; sagittal crest well-developed, attaining elevation of 4.5 mm.; paroccipital processes short and blunt, their width apart, 32.5 mm.; epipubic bones 30 mm."

The cotypes of *P. leucippus* are marked "type," one at Genoa, C.E. No. 10454, the other at London, B.M. No. 97.8.7.88. Both are adult males, both from "Parte montuosa del Vanapa," collected by Loria. No altitude was recorded.

The chief difference not attributable to age appears in the length of the pelage (13-17 mm.), and even that difference may be accounted for by seasonal wear and molt. Both animals are somewhat younger and smaller than the type of *gymnotis*.

Phalanger gymnotis of Aru, collected by Beccari, and *P. leucippus* of the mainland have long been considered conspecific. Study of the type skulls and of a further extensive series of specimens confirms this view. Any doubts concerning the actual place of origin of the unique specimen of *gymnotis* are allayed by Beccari's unequivocal note (1924), in which he writes of the capture of the type on May 5: "The

natives state that this animal is terrestrial, that it does not climb trees, and that they call it 'guannal cafa.' They say that the females have the same color as the males."

In connection with Beccari's note that *P. gymnotis* is terrestrial, it may be remarked that the specimens taken by the writer were found in rocky places—in forest at the base of rock outcrops. But also two were shot at night by jacklight when they were 20 feet up trees.

The American Museum series from Wetar Island were assumed earlier (Tate and Archbold, 1937) to be typical of *P. o. orientalis*. Later study of a topotype of *orientalis* in the British Museum collection showed this assumption to be wrong. The unusually large size of p_4^2 in the Wetar series makes it probable that affinity with *gymnotis* exists, and for the present the Wetar animals will be so regarded. *P. orientalis* from Timor, according to Jentink (1885), lack the dorsal line. Their colors are light brown or whitish, with underparts white. Albinistic males are said to occur however, as in true *orientalis*. Close relationship between the striped cuscuses of Timor and Wetar may be expected.

Phalanger vestitus

The silky phalangers were treated (Tate and Archbold, 1937) under the name *Phalanger sericeus*, as *P. vestitus* (Milne Edwards), 1877, was then uncertainly identifiable from the literature. More recently the type specimens of *vestitus*, *sericeus*, *coccygis*, and *carmelitae*—all proving to be silky phalangers—have been studied and their skulls have been photographed. *P. vestitus*, which is an older name than *P. sericeus* Thomas, 1907, must be employed for the silky species instead. *P. carmelitae*, which was placed by us in the *orientalis* group, has also proved, on examination of the type, to be a close relative of *vestitus*.

Much new material referable to this group has resulted from the work of the second and third Archbold New Guinea Expeditions; part of this is from the Central Range, east of Port Moresby, and from the region about Lake Habbema and

Mount Wilhelmina in central Netherlands New Guinea.

MATERIAL EXAMINED: Huon Peninsula (*coccygis*): six specimens previously reported (none additional); Port Moresby area: six specimens from Kagi, 5000 feet, foot of Mount Albert Edward, in addition to six *sericeus* and two *carmelitae* previously reported; Mount Wilhelmina area: 22 specimens (10,000 to 11,000 feet); Weyland Mountains: two specimens collected by Klein. The types of *vestitus*, *carmelitae*, *sericeus*, and *coccygis*.

The type of *Cuscus vestitus* Milne Edwards was described as having long, silky pelage, colored glossy black, with sides more grayish, "...underparts pure white. The single specimen is young, for its replacement molar is still developing. It measures 520 mm. from muzzle to tip of tail, the latter having 240 mm. . . ."

The type specimen of *vestitus* from Karons Mountains, Tamru Mountains, northern Vogelkop, which was placed by both Jentink and Thomas in the synonymy of *P. orientalis*, is a juvenal male, the skin mounted and carrying the numbers 289 (204A), 1477, and the date 1877. Pelage soft and silky, with well-defined dorsal stripe from head to lumbar region, stripe widest at the withers, 25 mm. Present general color dark brownish gray, underparts creamy white, with a central patch of pure white beneath neck and chest. None of the white hairs with gray bases.

The back of the skull is sliced off. The first and second molars only have been erupted (stage 2), and the milk premolars remain unshed. One side of the face has been cut away to show the permanent upper fourth premolar, which is only partly developed. The pointed i^1 and c are but partly erupted; i^2 is very large and well worn; i^3 is small and appears slightly worn. Even in youth the skull shows the pear-shaped outline characteristic of *sericeus* and *coccygis*. The lengths of the crowns (in the tooththrow) of i^2 and i^3 are, respectively, 3.5 and 1.3 mm. The crown dimensions of the two erupted molars, m^1 and m^2 are, respectively, 5.7 by 3.8 and 5.2 by 4.2.

Phalanger vestitus differs from both

sericeus of the Central Range of Papua and *coccygis* of the Saruwaged Mountains chiefly on account of the small size of its molar teeth.

The types of *P. carmelitae*, *sericeus*, and *coccygis* seen by me include the type and four paratypes of *carmelitae*, all collected by Loria in 1894 on the upper Vanapa

P. vestitus, with races

P. vestitus vestitus

P. vestitus carmelitae (= *sericeus* = ? *coccygis*)

Saruwaged Mountains is obscured by the extreme youth of the single known specimen. The narrowness of the first molar may be significant, and this with the apparently extensive geographical gap in distribution (fig. 9) may perhaps warrant retention of the subspecific rank. The silky phalangers, then, may be arranged

Northern Vogelkop

Central and Saruwaged ranges

River, which rises on the slopes of Mounts Scratchley and Victoria, and numbered as follows: the type, Genoa C.E. No. 10455; the paratypes, Genoa C.E. No. 10456-10457 and B.M. No. 97.8.7.87. Detailed measurements were taken of the skulls and teeth of the type and one of the paratypes in Genoa and of the London paratype. The holotypes of *sericeus* and *coccygis* were also examined. A series of measurements is shown in tables 4 and 5.

The animals of the Central Range, from Weyland Mountains to Mount Albert Edward, now appear not to differ from each other even to the extent of forming eastern and western geographical races. I am persuaded that the seeming differences between *carmelitae* and *sericeus*, whose type localities are only a few miles apart and on the same southern face of a winding though uninterrupted mountain range, are fictitious, being founded upon differences of age and molt. The presence or absence of p^3 likewise is not significant; this tooth is present in 7 out of 13 in the eastern members of the *P. vestitus* group but is lost on both sides in 6 out of 20 specimens from near Mount Wilhelmina. The tooth is present in one of the specimens from Weyland Mountains; an appropriate alveolus appears in the type of *vestitus*; and the tooth is present in the type of *coccygis* from the mountains of the Huon Peninsula.

After personal inspection of the type of *P. coccygis* and in view of the fluctuating status of p^3 , retention of this form as a separate race, even though geographically isolated, seems inadvisable.

The relationship of *vestitus* of the mountains of northern Vogelkop to the silky phalangers of the Central Range and

Phalanger celebensis

The view suggested earlier (Tate and Archbold, 1937, p. 315, diagram) that *celebensis* might be treated as a group coequal with the *orientalis*, *ursinus*, and *maculatus* groups of *Phalanger*, is now modified. *Phalanger celebensis* (fig. 8) is now regarded as one of the four full species comprising the *orientalis* group: *orientalis*, *gymnotis*, *vestitus*, and *celebensis*. This relationship is emphasized by study of a good series of a new race from Peleng Island. In these, as in the race *rothschildi*, the form of the mastoid area is somewhat more in agreement with that of *orientalis* than with true *celebensis*. In other respects they agree closely with *celebensis*.

Phalanger celebensis with its races is to be distinguished from *P. orientalis* and races by its skull size and by the distance of i^3 from c . In *P. orientalis* (except *ornatus*) the alveoli of the two teeth are separated by an appreciable gap. In that respect *ornatus* connects *orientalis* and *celebensis*.

The races of *P. celebensis* are four:

<i>P. c. celebensis</i>	Of the mainland of Celebes, both north and south
<i>P. c. pelengensis</i>	Peleng Island
<i>P. c. rothschildi</i>	Obi Island
<i>P. c. sangirensis</i>	Sanghir Island

The representative of *celebensis* found on Taliaboe of the Sula group of islands, east of Celebes, appears to be intermediate; it matches true *celebensis* in general color, though its hands are tan instead of gray; on the other hand its skull has the mastoid processes downwardly pointed as in the other island races of that species.

Phalanger celebensis celebensis (Gray)

Cuscus celebensis GRAY, 1858, Proc. Zool. Soc. London, p. 105.

Phalanger celebensis THOMAS, 1888, Catalogue of the Marsupialia . . . in the British Museum, p. 207.

MATERIAL EXAMINED: The type specimen as well as photographs of the skull; our original series from south Celebes (Tate and Archbold, 1937, p. 379); also eight specimens from near Roeroekan, northeastern Celebes.

The type, B.M. No. 57.8.6.3, is a young adult male (m^4 not yet quite in place). The upper pelage is gray, the underparts white; no dorsal stripe. The usual coarse granulations beneath the base of the bare part of the tail also indicate its sex.

The back of the skull behind the palate is wholly sheared off. Upper m^4 of the right side is missing; that of the left side has been glued in at right angles to its proper position, its anterior face outward, thus shortening the total length measurement of the tooththrow. True length of tooththrow, $p^4-m^4 = 18.5$; p^4 with slightly developed cuspules as in *gymnotis* but the tooth very much smaller (3.9 by 3.2).

Juvenals, according to Weber, are rufescent.

No differences between southern and northern animals appear.

Phalanger celebensis sangirensis Meyer

Phalanger sangirensis MEYER, 1896, Abhandl. Mus. Dresden, vol. 6, art. 6, p. 34.

"They differ slightly from the Celebes specimens *celebensis* in their golden tint; they are warmer and brighter generally, and the face is more or less paler. . . In the five specimens which lie before me there is a

slight trace of the dorsal stripe. . . " (Meyer).

This is the only race of *celebensis* of which I have not seen the type specimen. No measurements of the animals were given by Meyer. The color, as described, well matches that of *pelengensis*, but the presence of the weak dorsal stripe in *sangirensis* separates the two. It may be identical to *rothschildi* of Obi, which also possesses a dorsal stripe, but I hesitate at this stage to synonymize the two. It must always be borne in mind that these easily domesticated phalangers may have been carried about in canoes.

Phalanger celebensis pelengensis Tate

(See description, p. 3.)

Phalanger celebensis rothschildi Thomas

Phalanger rothschildi THOMAS, 1898, Novitates Zool., vol. 5, p. 433.

The type of *rothschildi*, B.M. No. 98.3-27.1, is a young male, with the back of the skull cut off. Thus, the form of the mastoids cannot be seen. The widths of the upper incisors measure: i^1 , 2.5 mm.; i^2 , 3.1; i^3 , 1.7.

The skin (in the Tring Museum) is colored light brown, much as that of the new race *pelengensis*, but differs by possessing a distinct dorsal line on the crown of the head and from shoulders to rump. Under parts creamy white instead of the clear yellow of *pelengensis*.

A second specimen, an adult female, also from Great Obi, Genoa C.E. No. 10306, is reddish gray, with creamy white underparts and the chin and anterior part of the throat brownish. The frontal trough deep. Widths of upper incisor crowns: i^1 , 2.4 mm; i^2 , 2.9; i^3 , 1.7.

PHALANGER MACULATUS GROUP

The phalangers of the *maculatus* group are distinguished from those of the *orientalis* and *ursinus* groups by pronounced inflation of the frontal region of the skull. Another character distinguishes the males only of the *maculatus* group from all except *P. orientalis ornatus* and *P. o. lullulae*; this is the strongly spotted pattern. A

third character relates to the quite involved changes in the color and pattern of the pelage undergone during growth.

Two species of spotted phalangers are recognized in this paper, *P. maculatus* with its five geographical races, and *P. atrimaculatus*, newly described (p. 4).

A. *P. maculatus*1. *P. m. maculatus*

Tan and white, with white aberrations in both sexes. North New Guinea.

2. *P. m. krämeri* = *rufoniger*

Male with dark head, most spots dark, on white ground, female dark throughout, with reddish tail, hands, and feet. A white aberration occurs. Admiralty and Ninigo Islands. Also Huon Peninsula.

3. *P. m. chrysorrhos*

Male with tan-spotted shoulders, chocolate-spotted hind-back; female with dark gray to blackish rear-back, with or without weak lateral line. South New Guinea and southern Moluccas.

4. *P. m. goldiei*

Male much whiter than *chrysorrhos*, tan coloring much reduced and chocolate spots few only and on rump. Female almost indistinguishable from that of *chrysorrhos*. South-east New Guinea.

5. *P. m. nudicaudatus*

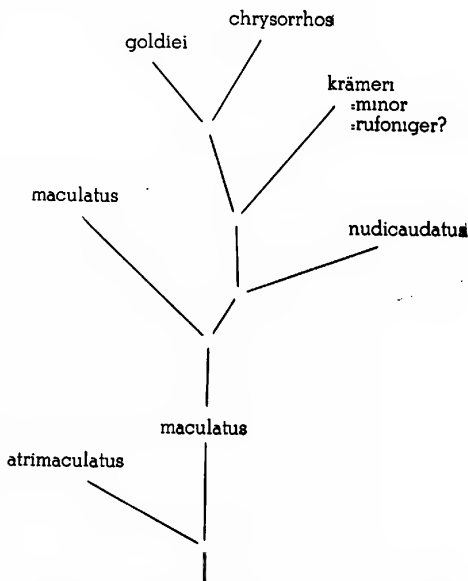
Tan coloring, if present, restricted to hands, feet, and tail. Spotting in male gray on white base. Female unspotted, gray above, white beneath. North Queensland.

B. *P. atrimaculatus*

Male with rear back spotted with jet black. Possibly equals the form on Waigeu in which female is also spotted. Range: ? Waigeu, ? Batante, ? Misol, and sparsely through north New Guinea as far as the Sepik River.

The interrelationship of these races is still doubtful. The two forms *chrysorrhos* and *goldiei* from south of the main divide appear very closely related, partly because of geographical considerations and partly because their females are nearly indistinguishable. The gray Australian race has not only a sharply different color tone; it is much smaller. It appears more closely related to *chrysorrhos*, its nearest neighbor, than to other races. Of the spotted phalangiers north of the mountains, the status of *P. atrimaculatus* is obscure. The frequent presence of p^3 , coupled with the form of the ectopterygoids, indicated that it is sharply different from all other spotted phalangiers. True *maculatus*, with its white variety, is again a perfectly distinct geographical entity. The Admiralty Islands race, *krämeri*, strongly saturate in color and much reduced in size, may be derived directly from *rufoniger* of the Huon Peninsula. It lacks p^3 . Its possible phylogenetic history appears in figure 6; its pattern of geographical distribution, in figure 7.

Treatment of *atrimaculatus* as a full species has seemed desirable because its range and that of *P. m. maculatus* overlap extensively. The indications of geographical overlap between *maculatus* and *chrysorrhos* that appear in the Vogelkop are not well substantiated. *Chrysorrhos* and *goldiei* may be found to intergrade in the Papuan Gulf area.



eastward range of the race *goldiei* remains unascertained. Lydekker, in Allen's "Naturalist's library" (1894), states of the spotted phalangiers, "unknown in the Halmahera group." Mertens (1929, p. 29) records them from eastern Flores, but Sody (1933, p. 61) questions this record.

Peters and Doria (1881) and Jentink (1885), four years later, provided short descriptions of many individual specimens of spotted phalangiers from the Moluccas and western New Guinea. In some instances, naturally, unimportant characters

spotted like our south New Guinea males, also that the lateral line in dark-backed females is not a highly significant character, since, though it is stated positively to be present in typical *chrysorrhinos* of Amboina and by inference in the females from Padjang, Andai, Salayer, and Aru (two), it is particularly stated to be absent, "no black line separates the red-brown flanks from the white abdomen," in one specimen (No. 27) from Aru, and in a young female from Numfor (= Mafoor), in the Geelvink Bay. That the lateral line in these females is

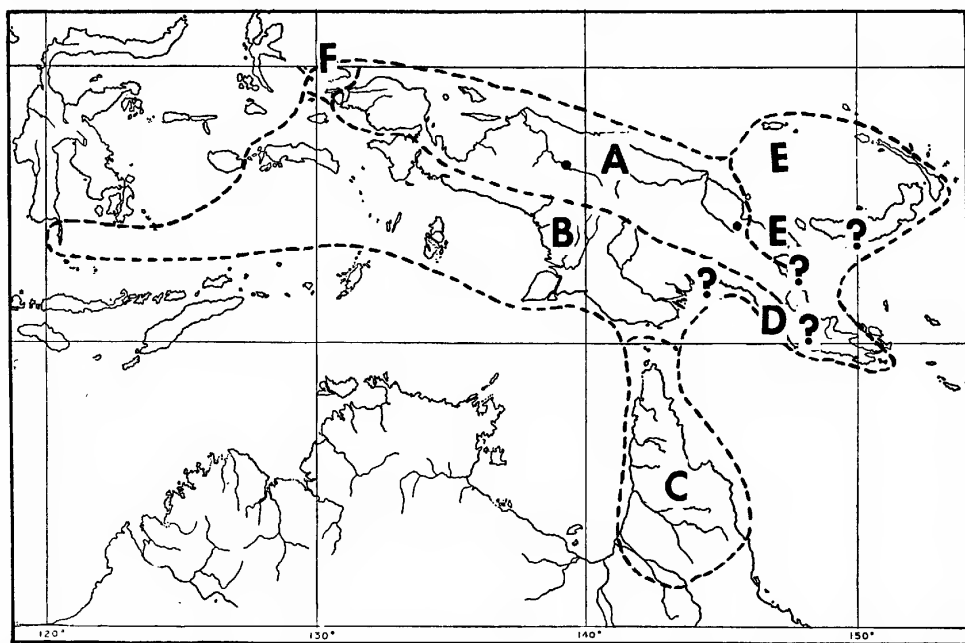


Fig. 7. Pattern of apparent distribution of the *P. maculatus* group: (A) *P. m. maculatus*; (B) *P. m. chrysorrhinos*; (C) *P. m. brevicaudatus*; (D) *P. m. goldiei*; (E) *P. m. krämeri*; (F) *P. m.* race with spotted females. The interrogation marks show lack of knowledge of the race on New Britain and of the eastward extent of the ranges of *P. m. maculatus* and *P. m. goldiei*. The two dots mark *P. atrimaculatus*.

were mentioned, while diagnostic characters were omitted. An attempt to evaluate these descriptions and allocate the individuals to races is made in table 6. Races apparently involved are (1) true *maculatus* with its white form; (2) "sooty"-spotted animals from Waigeu, males and spotted females; and (3) *chrysorrhinos* of Ceram, females only (males not positively associated).

It appears that the males of topotypical *chrysorrhinos* females must be chocolate

really a fluctuating and uncertain character is substantiated by study of two borrowed females, one adult and one half-grown, from Ceram. In the younger one no trace of lateral line appears; in the adult a very slight irregular deepening of the dark gray is the only indication of it. So also with most of our south New Guinea material. In a few cases the sides, adjoining the white of the belly, are slightly darker. Thus the south New Guinea race, which must also be referred to *chrysorrhinos*, is seen ranging

west and northwest to Aru, Kei, Ceram, and adjoining islands, even to Salayer, and on the mainland thrusting northwest along the south side of the mountains into the southern part of Vogelkop (Triton Bay). A single specimen from Andai indicates extension northward along the east side of Vogelkop.

According to Jentink the phalangers with "sooty black" spots occur on Misol Island, animals with "glistening black" spots on Waigeu, with "black" spots on Ceram, and "sooty black—same as no. 28" on "New Guinea."

It is unfortunate that females of *atrimaculatus* were not secured by the Archbold collectors. That part of the problem relating to spotted females seems to be insoluble for the time, as two types of females apparently occurred: on Misol "back and flanks sooty," on Waigeu "colored and spotted like the males. . . underparts pure white;" on New Guinea (Andai) "midmost part of back sooty black. . . underparts pure white." On Ceram no females were recorded.

The term "sooty black" in the case of females is less distinctive and, therefore, less convincing than in the case of males. That is because females of all the races except *P. m. maculatus* have blackish or very dark brown backs.

Spotting in females in *Phalanger*, although known to be frequent on the island of Waigeu, is by no means restricted thereto. Occasional spotted females are known from Aru and Kei, and an aberrant one, A.M.N.H. No. 108102, with small dark gray spots on a light gray ground, comes from Penzara, Wassi Kussa (River), south coast of south New Guinea. A second but juvenal individual, U.S.N.M. No. 267395, with apparently similar type of pelage, is from western Ceram. Spotted females, except those from Misol and Waigeu, appear to be referable to the race *chrysorrhos* and to occur only as occasional aberrations. It is suggested—without expression of definite opinion—that the black-spotted males and females of Misol and Waigeu may represent an extension of the species *atrimaculatus* to those islands. Whether the black-spotted females are truly the females of *atrimaculatus* or are the product of a localized genetic change must be decided when more evidence has been procured.

Phalanger maculatus maculatus (Geoffroy)

Phalangista maculatus GEOFFROY, 1803, Catalogue des mammifères du Musée National d'Histoire Naturelle, Paris, p. 149.

Phalangista papuensis DESMAREST, 1822, Mammalogie, p. 541.

Etienne Geoffroy St. Hilaire in 1803 published the first description of a spotted phalanger under the name *maculatus*. ". . . Characters. Fur white, spotted with brown; two lateral incisors in the lower jaw. Description. Fur of the upper parts of the body yellowish white, spotted with brown; the two lateral teeth very large and triangular, in height almost filling the interval between the incisors and the molars; ears hairy inside as well as outside; claws very small. Country. The Moluccas."

The name *maculatus* Geoffroy must be fixed upon one of the recognizable geographical races, and its type locality must be restricted, preferably fixed. Buffon had earlier described and figured a male "*Phalanger tacheté*" without binomial name. It is well spotted, neither densely nor thinly. There is no visible suggestion that the spots of the rear back are at all darker than those of head and shoulders, as is the case in males from south New Guinea. This fact coupled with Geoffroy's simple, "white, spotted with brown," may be taken to indicate the race (males only) now known to be most abundant in north New Guinea. This race has large brown spots and blotches. unmixed with chocolate or black, upon a white ground, and is distributed in north New Guinea from the Vogelkop at least as far east as the lower Sepik River. The Archbold Collection contains a large series from the Cyclops Mountains area and from the upper Idenburg River, 150 feet.

There remains the problem of restriction of type locality, given by Geoffroy as "Moluccas." No evidence exists that this particular race, the pale brown spotted phalanger, occurs at all on the Moluccas as delineated today, or indeed on any of the islands west of the New Guinea mainland.

It is present, however, on the islands in the Geelvink Bay.

For a long time before Geoffroy wrote (1803), the Dutch had been administering the Moluccas from a center located at Amboina. Subadministrative centers, co-operating with the local sultans of Ternate and Tidore, functioned at Ternate, Waigeu, Kei, and Dorei (= Manokwari) on New Guinea. The history of voyages of discovery leading to present-day development of the Moluccas and New Guinea has been ably traced by Wichman (1909). Recently Vlekke (1943) has illustrated the political and trading picture and the domination by the two sultanates Ternate and Tidore of the Moluccas and western New Guinea (see his maps, facing pp. 136, 304).

In view of the fact that western New Guinea was in 1800 considered a part of the Moluccas, and that typical *maculatus*, though plentiful on the mainland, is apparently absent from the islands west of New Guinea, I now restrict the type locality of *maculatus* Geoffroy, 1803, to the Vogelkop, and specifically to Dorei (now Manokwari), which was then the most important port of call in the region. This restriction has been fortified by my examination of a Chicago Museum specimen from Manokwari, F.M.N.H. No. 31754, female, which represents in my opinion true *maculatus*. A pair, male and female A.M.N.H. Nos. 100881, 100882, from Momi (virtually equal to Wariap), on the west coast of the Geelvink Bay and only 50 miles south of Manokwari, further substantiate the identity of true *maculatus*. Concerning a male from Dorei (No. 42), Jentink (1885) wrote, "spots are of a very light tinge, giving the impression as if the animal is entirely white colored. Perhaps an albino." The male from Dorei (= Manokwari) described by Peters and Doria (1881) was colored "head, neck and inner part of limbs ferruginous; back yellowish, spotted with brown, underparts and tail reddish yellow." There can, therefore, be no possible doubt of the presence of this race of spotted phalangers in the restricted type area.

Phalanger papuensis Desmarest can be

synonymized almost exactly with my young female *P. m. maculatus* in stage 2: "body gray; top of head brown; underparts yellowish white; extremities of fingers and feet brown. . . a little smaller than the white phalanger."

Phalanger quoy Gaimard and *P. macrourus* Lesson and Garnot, included by Cabrera (1919) in the synonymy of *P. maculatus*, are now placed in the *orientalis* group for reasons given thereunder.

Phalanger variegatus Schinz, 1821, due to the present inaccessibility of the work in which it was described, has not been identified. It may be either one of the *maculatus* group or *ornatus*, judging from its name.

GROWTH STAGES

The Archbold series representing this race is much larger than in the case of *P. m. goldiei* but is still inadequate to show all the growth stages. Collections from two main localities are before me: from Hollandia and the region about the Cyclops Mountains, and from the upper Idenburg River. A tendency toward dilution of the pigmentation possibly results in completely white specimens of both sexes. But a complete series from brown to white is wanting. Brown and pale brown individuals are separated by a wide color gap from white or yellowish white ones.

The growth stages (table 7) of *P. m. maculatus* from two areas in north New Guinea, when compared with the more complete series (table 8) for *P. m. chrysorrhoeus* of south New Guinea beyond, show that females of the northern race become actually larger than males, as stated by Jentink, but that in the southern race this does not hold.

Comparison of *P. m. maculatus* from the north coast with the strain found inland on Idenburg River reveals further small differences, which must be viewed with reserve on account of the small number of samples. The inland race appears to reach greater over-all size than the coastal race; this is expressed chiefly through greater tail length and foot length.

COLOR PATTERN

Because of the woolly character of the pelage, none of the three specimens in stage 1 is to be regarded as pouch young. Known pouch young (i.e., *chrysorrhos*) have without exception extremely short fur. Although the dentition has developed only to stage m_1^1 , the pelage is very different from that of our specimens of the race *chrysorrhos* actually found in the pouches, being longer, slightly crimped and glossy, with an indication of the adult pattern. In the very young male from the Idenburg River, faint dark gray spots show on a ground of lighter gray. In the younger female from the Cyclops area, the color is gray, but the dark lateral line is already well defined, and the face, hands, feet, and tail show traces of rufescent coloring. The gray dorsal color of the older stage-1 female, slightly further advanced, has already become considerably paler.

Stage-2 animals already show a marked change in the direction of adult pattern. In the several males the brown spotting on a white ground is clearly established; the light brown spots are still mixed with darker, not clear brown as in adults. Females are in various states of transition from gray to brown, their lateral lines strongly defined.

Stage 3 in every case already shows adult color pattern.

Phalanger maculatus chrysorrhos
(Temminck)

Phalangista chrysorrhos TEMMINCK, 1827, Monographies de mammalogie, vol. 1, p. 12.

When we worked upon the relationship of the spotted phalangers earlier (Tate and Archbold, 1937), our material from south New Guinea was assumed to be identical with the race *goldiei* Ramsay from Port Moresby, which was based upon a single female. Recent collection of several topotypical males of *goldiei* indicates that the south New Guinea spotted phalanger belongs not to *goldiei* but to a distinct race, and that it appears referable to *chrysorrhos* Temminck.

The following is a detailed description of an adult male of this race: A.M.N.H. No. 108083, adult male from Lake Davi-

umbu, middle Fly River. Basal coloring white; head, limbs, and tail light brown near Ochraceous Tawny, becoming rufescent on feet and hands; ear tufts white; back, from shoulder to rump, spotted with dark chocolate brown often nearing Mummy Brown, the density of the spotting such that there are about as many white spots as chocolate spots. This dark brown spotting extended onto the hind limbs. Underparts white.

Description of skull of same: a characteristically *maculatus*-like skull of moderate size, in growth stage 4 (m_4^4 developed but unworn). No characters to distinguish skull from other races.

MEASUREMENTS: Skin (taken in field), total length, 1030 mm.; tail, 510; hind foot (s.u.), 82. Skull, condylobasal length, 95; zygomatic width, 62; palatal length, 54; mastoid width, 48.5; outer width across p^4 - 4 , 32; toothrow, length, c - m^4 , 47.5; p^4 - m^4 , 31.2; p^4 , 6.3 by 5.9; m^4 , 6 by 5; mandible, front of incisive alveolus to articular process, 72.

A very large series of specimens of all ages and both sexes is available from various parts of the Fly River basin and the Oriomo Ridge (south of the Fly River). A study has been made beyond of the growth stages of this race.

A few examples showing reduction of the quantity of spots in males appear to be annectant with *goldiei*. The contact area of the two races is presumed to be in the Gulf Division (Kikori area), from which region no material is available.

Phalanger chrysorrhos Temminck was founded upon dark-backed females marked with a character otherwise peculiar to true *maculatus*, namely, the dark lateral line which separates the dark dorsal coloration from the whitish ventral. When I examined the two female cotypes at Leiden I was unaware of the significance of the lateral line and so failed to remark its presence or absence. In females of *chrysorrhos* from south New Guinea, although the dark along the sides is intensified—chiefly by reduction of the dorsal covering of whitish guard hairs—there is no narrow contrasting line such as is seen in females of *P. m. maculatus*. Yet Temminck wrote "the white of

the underparts is separated from the ashy which covers the sides by a black band in adults, only blackish in young individuals." He also alluded to males, but there is actually no description in his work of animals which are unquestionably toptotypical males of *chrysorrhos*.

GROWTH STAGES

The Archbold Collection contains more than 50 specimens of the race *P. m. chrysorrhos*. The salient growth characters correlating dental development with progressive changes of pelage and skull development are set forth in table 8. Five stages in dental development are recognized. No evidence can be drawn from the dates of capture tending to show seasonal breeding rhythm; reproduction seems to take place at any time through the year.

The two males and the female appearing in stage 1 were actually collected from the pouches of females. Increase in length of the tail seems to cease at stage 4 in females, as does also increase in zygomatic width.

COLOR PATTERN

The development of the pelage can be readily traced in the two sexes. In the pouch young the fur is short and close, slaty gray dorsally and dull white ventrally. An indication of developing pattern shows in one of the males (A.M.N.H. No. 108-099), in the buffy white ears and some irregular buffy patches on the hind limbs and at the base of the tail.

Pelage in both sexes develops rapidly after the pouch has been vacated. Males in stage 2 already show weak grayish brown dorsal spotting on a ground color pale silvery gray, with ears buffy white. Females of corresponding age have the dorsal color brownish gray, sometimes more reddish, with sharply contrasting buffy white ear patches, and the ventral color and inner sides of limbs white. No trace can yet be observed of the blackish color of the posterior half of the back, present in adult females. This stage corresponds to the "nebulous" phase of Jentink.

In stage 3, most males have already assumed the bright adult coloration. Fe-

males yet retain to some extent the silvery hair tips and indefinite pattern of stage 2, but the lower dorsal area is definitely becoming darker brown.

In stage 4, fully adult coloration has been reached by females as well as by males. The coloring of males is shown in the detailed description given earlier. That of characteristic females is as follows: Normally no spots developed. Posterior half of back uniform deep blackish brown, the tips of hairs shining buffy—rarely silvery; face, hands, and feet light chestnut, fore-back, neck, shoulders light brown, tail light brown. In both sexes the rump adjoining the base of the tail is light yellow-brown. No sharp lateral line such as shows in *P. m. maculatus*, but the sides appearing blacker due to absence of pale guard hairs. Hence, probably, Temminck's description of *chrysorrhos*.

ERUPTION OF TEETH

Functional teeth are limited in stage 1 (pouch young) in the upper jaw to the large, flat-crowned, permanent second incisor, i^2 in adult dentition, the milk fourth premolar, and the first molar (which is not quite in position); and in the lower jaw to the projecting tips of the large procumbent incisor, the lower milk fourth premolar and the lower first molar. In the upper series the tips of the permanent i^1 , the flat-crowned i^3 and p^2 are just visible. The canines are only partly erupted. On the other hand the very small tubercle-like, lateral lower incisors (or premolars?) are already rounded and worn. They were perhaps used in the pouch before the eruption of the procumbent incisors for holding the mamma, and opposed the flat-crowned i^2 . At stage 1 they are close together, almost contiguous, though destined before adulthood to move a full crown-length apart.

In stage 2, which by definition has m_2^2 in place, the principal additional change in the teeth appears in the incisors, canines, and premolars. The pointed i^1 and the flat-crowned i^3 are both in place, the latter already exhibiting slight wear. The canine, though functional, is still only partly extruded. The second premolar is fully

erupted. The procumbent lower incisor is fully functional, though still only partly erupted. The frontal swelling, characteristic of all *maculatus*, unrecognizable in stage 1, is quite well developed in stage 2.

In stage 3, with m_3^2 in place, the earliest developed incisor, i^2 , is in an advanced state of wear, and both i^1 and i^3 show moderate wear of the crown surfaces. The canine and p^2 are farther protruded. The most significant feature of this growth stage, however, is the replacement of the milk fourth premolar by the permanent premolar. In three of our stage-3 males the milk tooth is still functional, in two others it has been thrust aside by the erupting permanent tooth, and in the female, which is a larger, more advanced animal, the milk tooth has been displaced and the permanent tooth is fully in position. The lower incisors are now thrust forward so far that the whole of the flattened, chisel-shaped crown is about 2 mm. beyond the alveolus.

Stages 4 and 5, respectively, with m_4^4 in place, unworn, and m_4^4 much worn, offer only progressive additional phases of wear in the earlier developed teeth. The first incisors have continued lengthening and thickening from their persistent pulps and because of attrition of their posterior faces by the lower incisors have assumed a somewhat chisel-like form. The crown of i^2 is much eroded; in stage 5 it may be completely worn down to the stump-like root. The crown of i^3 , a non-persistent tooth, often shows oblique wear from rubbing against the lower canine.

In stage 5 the canine, second premolar, and the first incisor may show extreme wear, being either broken or reduced in some cases to rounded stumps.

Males in stage 5 show the anterior part of the zygoma with greater flare, which causes the point of maximum zygomatic width to lie farther forward than it does in most stage-4 skulls.

Phalanger maculatus goldiei (Ramsay)

Cuscus chrysorrhos var. *goldiei* RAMSAY, 1876, Proc. Linnaean Soc. New South Wales, vol. 1, p. 395; 1879, *ibid.*, vol. 3, p. 243.

MATERIAL EXAMINED: Our original

female (below), and a series of five males and three females, all from near the type locality.

The type has not been studied. Ramsay's description was based upon a female. As stated earlier, the females of *goldiei* are nearly indistinguishable from females of *chrysorrhos* in our collection from south New Guinea.

When we wrote before (Tate and Archbold, 1937), a single female of *goldiei* and a short series of *chrysorrhos* from south New Guinea only were available, and the differences provided by the males could not be noted.

Description of adult male: A.M.N.H. No. 108121. General color white above and below, becoming very slightly yellowish on top of neck and shoulders. A few large brownish or blackish spots on mid-back, either scattered or partly confluent, never anastomosing to form large brown areas as in males of *chrysorrhos*. Top of face anterior to ears, hands, and feet dark tan. A few gray marks on outer sides of hind legs.

The skull differs from that of south New Guinea *chrysorrhos* by its rather more tapered outline and especially by the great size of the molar tooth series; m^4 in particular is large (7 by 5.8 mm., compared to 5.5 by 4.8 in A.M.N.H. No. 104404 from south New Guinea). Corresponding differences show in the lower molars.

Juvenal specimens are also very pale. Spotting in them originates as a few silvery gray and light brown marks on the back.

Limits of range in the case of this race are not known. Our specimens come from behind Port Moresby and from the Kemp Welch River, a few miles to the southeast.

GROWTH STAGES

A poor representation of the growth stages is available:

Stage 2, one male

State 4, four males, two females

Stage 5, one male, one female

The stage-2 male shows no significant differences in the manner or order of development. It is distinctly older within its group, m_2^2 being fully, instead of nearly, in place. The pelage pattern is rather more mature.

No significant differences in the growth pattern, as outlined under *P. m. chrysorrhos*, are observable in the adults and old adults.

Phalanger maculatus nudicaudatus
(Gould)

Phalangista nudicaudatus GOULD, 1849, Proc. Zool. Soc. London, p. 110.

Cuscus brevicaudatus GRAY, 1858, *ibid.*, p. 102.

Cuscus brevicaudatus GOULD, 1860, Mammals of Australia, vol. 1, pl. 21.

Cuscus maculatus var. *ochropus* GRAY, 1866, Proc. Zool. Soc. London, p. 220.

Gray renamed this animal *brevicaudatus*

and teeth, is decidedly smaller than that of adjoining New Guinea.

The type of *nudicaudatus* from "Cape York" is a juvenal female (stage 1), B.M. No. 51.1.11.17. The skin is colored gray with buffy white underparts and carries no distinctive marks. A second specimen, B.M. No. 23.12.16.33, adult female from Lloyd's Bay, is also gray and white. An adult male, stage 4, M.C.Z. No. 29271, from the McIlwraith Range, is white, with the back heavily spotted and marbled with gray, becoming continuously gray on head,

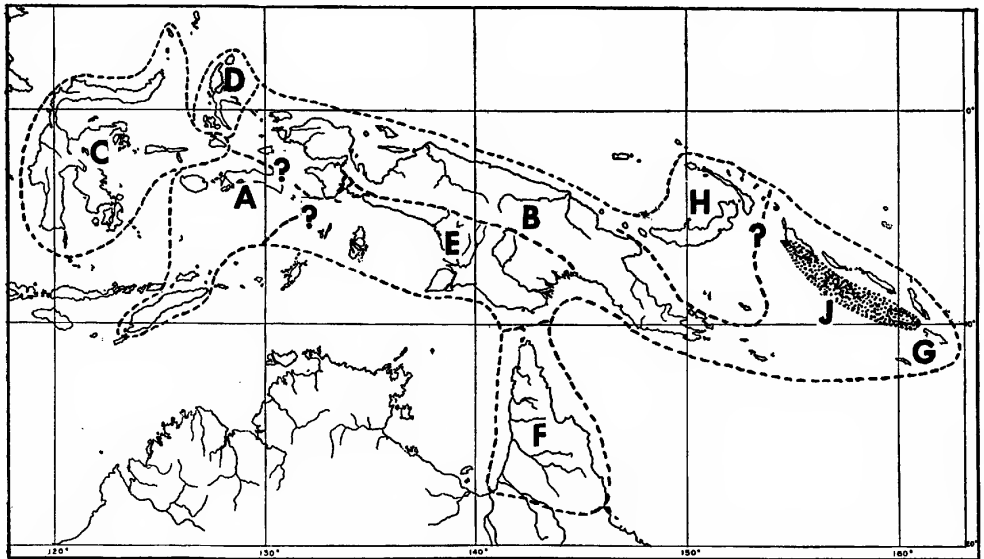


Fig. 8. Apparent pattern of distribution of the *P. orientalis* group (part): (A) *P. o. orientalis*; (B) *P. o. vulpecula*; (C) *P. celebensis*, full species; (D) *P. o. ornatus*; (E) *P. o. mimicus*; (F) *P. o. peninsulæ*; (G) *P. o. breviceps*; (H) *P. o. ducatoris*; (J) *P. o. race*, the chocolate-colored, *vestitus*-like form of the southern arc of the Solomons. Interrogation marks indicate uncertainty in regard to boundaries.

and described *ochropus* on the basis of its tan-colored feet. Agreeing with Iredale and Troughton (1934), I regard the two as subspecifically identical.¹

The Australian phalanger is, however, markedly different from its allies in New Guinea. The color is gray on white, rather than tan or brown and chocolate on white. When brown is developed it seems to be restricted to the feet. Furthermore, the size of the animal, together with its skull

neck, and shoulders. Tail white, no brown on hands and feet.

The type of *ochropus*, B.M. No. 66.4.23.4, from Port Albany, is an old female. It is also gray, but the feet are colored light tan.

Some dimensions of the skulls of the foregoing types are submitted for comparison (table 9) with those of *chrysorrhos*, *goldiei*, and *maculatus*.

Phalanger maculatus krämeri Schwarz

Phalanger maculatus krämeri SCHWARZ, 1910, Sitzber. Gesellsch. Naturf. Fr. Berlin, p. 406.

Phalanger maculatus minor COHN, 1913, Zool. Anz., pp. 507-516.

¹ Although the type specimen of *brevicaudatus* Gray is a member of the *maculatus* group, Gould's plate, labeled "*brevicaudatus*," shows a gray cuscus essentially similar to the new *P. o. peninsulæ*.

Phalanger maculatus rufoniger ZIMARA, 1937, Anz. Akad. Wiss. Wien, p. 35.

MATERIAL EXAMINED: Our original small series of skins and skulls from Manus Island, Admiralty Group, including one white female.

The adult female *rufoniger* from the Sattelberg, Huon Peninsula, New Guinea, described by Zimara, may either be identical to *krämeri* or may represent the mainland parent form from which *krämeri* of

the Admiralty and Echiquier Islands has been derived. The description of its coloring agrees reasonably well with Admiralty females. No dimensions were given, nor were any particulars of the skull offered.

Phalanger atrimaculatus Tate

(For description of this second full species of the *P. maculatus* group, see p. 4).

PHALANGER URSINUS GROUP

These large phalangers of Celebes and the Talaut Islands are still thought to form a distinct offshoot of the genus; group characters were given earlier (Tate and Archbold, 1937). The unusually short, broad rostrum, the short canine, and the enlargement of i^3 require greater emphasis. Geographical distribution of this group appears in figure 9.

Examinations of the type specimens of *ursinus* and *melanotis* recently have provided a slightly different orientation of the systematic problem posed by this group. *P. melanotis* in particular is without doubt a sharply distinct race, only distantly related to *P. maculatus*. Although the superficial resemblance of its pelage to that of females of *P. maculatus chrysorrhoeus* lends some support to Schwarz's view (1934), the skull of *melanotis* reveals its unmistakable relationship to *ursinus*, especially in the broadening of the anterior nares, the enlargement of i^3 , and the reduction of the canine.

Phalanger ursinus

The group is limited to a single species composed of several races.

Phalanger ursinus ursinus (Temminck)

Phalangista ursinus Temminck, 1827, Monographies de mammalogie, vol. 1, p. 10.

MATERIAL EXAMINED: Four of the types collected by Müller and Macklot in north Celebes (three now at Leiden, one at London); our original small series; and two new collections; 24 specimens from the Peleng Islands.

The very black mountain race *furvus* from central Celebes, represented by three specimens, is retained, though, as shown in table 10, some of the size differences attributed to it are no longer valid.

The normally grizzled northern *ursinus* display few color variations of importance. But study of the teeth reveals a probably significant race character in the shape and size of the outer upper incisor. It has already been pointed out that in *ursinus* this is a well-developed tooth, thus differing from all other known species of *Phalanger*. The tooth assumes two forms, with occasional intermediates, and rarely a different shape on either side of the head. In the case of the Celebes specimens and those from Peleng Islands the crown of the tooth is relatively straight and its cutting edge blade-like, with sometimes slight indentations or flutings on the inner or outer faces of the tooth. In animals from the Togian Islands the crown is not only considerably elongated but is divided into a larger anterior cusp and a smaller posterior one, while a pronounced groove confluent with the depression between the two cusps appears on the outer face of the tooth. These differences show up partly in actual measurements (see p. 28).

It is to be noted that though *furvus* falls in with the second group as regards crown length, the crown in this race is not divided. This special development of i^3 is somewhat analogous to the folding of the enamel in i^3 of some Macropodidae.

Study of this long series of specimens has emphasized the rarity of really large, old

LOCALITY	NO. OF SPECIMENS	CROWN LENGTH OF I ³	REMARKS
North Celebes	6	2.7-3.1 mm. }	i ³ unicuspid; crown short
Peleng Islands	7	2.7-3.2 }	
Togian Islands	9	3.4-4.1	i ³ bicuspid; crown long
Middle Celebes	1	3.9 }	i ³ unicuspid; crown long
South Celebes	2	3.6-4.0 }	

animals in the *ursinus* population. Of all those examined, only four have skulls exceeding 100 mm. in length; these include a male cotype of *ursinus*, the type (male) of *furvus* (which was described as larger than *ursinus*), and two females from south Celebes. Extreme broadening of the frontal area and marked development of the sagittal crest are not attained until animals reach this size, though the dental series is completed and sexual maturity is reached at a considerably lower size level. Thus, all teeth are in place in animals whose skulls exceed 87 mm. in length. Most adults in the collections have the skull between 90 and 98 mm. in length.

In the grizzled race no color difference is apparent between males and females or between adults and young. No pouch young have been seen.

In general the animals from the north of the island have brown ears and brownish faces, while those from the center and south of the island have black ears and little or no brown on the face. This distinction is not strictly in accordance with the division according to the third upper incisor, as Togian Island specimens have the brown ears of northern animals combined with the grooved third incisors, while Peleng Island specimens, also with brown ears, have small, simple upper third incisors.

Phalanger ursinus melanotis Thomas

Phalanger melanotis THOMAS, 1898, Novitates Zool., vol. 5, pp. 2-3.

The type, B.M. No. 97.12.6.8, was recently reexamined. The general dorsal color is pale gray, the result of well-developed whitish hair tips with fuscous brown hair bases showing through slightly. The underparts buffy white, with gray bases. The skin looks slightly like that of female *P. maculatus chrysorrhoeus*, but shows many differences, notably the blackish ears, yellow hands, feet, and tail.

The skull is heavily built, with the nasals

expanded in front and behind much as in *ursinus*. The disparity between the interorbital and intertemporal widths, so noticeable in old *ursinus* (but only in old specimens), does not show in *melanotis*. The mastoid processes are not greatly expanded; they are rounded when viewed from behind and only slightly compressed from front to back. The teeth are substantially like those of *P. ursinus*, especially in the very short canine and the large size of i³. The last molar is unusually small. The crown length of the incisors, taken along the toothrow: i¹, 3.9 mm.; i², 2.7; i³, 3.3. Supplementary measurements of the type skull are given in table 10 for comparison with those of *ursinus*.

It will be noted that the crown length in i³ is intermediate between those of *ursinus* and *furvus*. No indication of a notched condition of the crown, such as appears in Togian Island specimens, can be seen in my photographs of the type skull. The black color of the ears agrees with the southern race *furvus*, not with *ursinus*.

Phalanger ursinus togianus Tate

(See description, p. 4.)

Phalanger ursinus furvus Miller and Hollister

Phalanger furvus MILLER and HOLLISTER, 1922, Proc. Biol. Soc. Washington, vol. 35, p. 115.

MATERIAL EXAMINED: One young adult male from the Latimodjong Mountains, 800 meters, near the type locality; two females from Mount Lampobatang, 2000 meters.

The glossy black pelage of the young male agrees closely with Miller's description of *furvus*. On the other hand the old animals from Lampobatang, formerly referred to *ursinus*, have the tips of the hairs grizzled, though the ears are black, not brown as in true *ursinus*. But comparative

study of the teeth in these animals, especially of i^3 , indicates similarity to each other and difference from the northern races. They differ from the Menado race, typical

ursinus, by having the crown length of i^3 much greater, and from the Togian Islands race by lack of the groove and double cusp in i^3 .

NOTES ON WHITE PHALANGERS

The appearance of white individuals in both *P. orientalis* and *P. maculatus* seems to be unrelated. In *P. orientalis*, white animals are invariably males. They appear in the typical race *orientalis* and again in the race *ducatoris* from the Bismarck Archipelago. In *P. maculatus*, the race *P.*

brought to him, he saw but one white one. He never once observed a white male with red iris, so reached the conclusion that he was dealing not with true albinism but with "a tendency to assume a white color in age." This appeared especially characteristic for Amboina (the type locality).

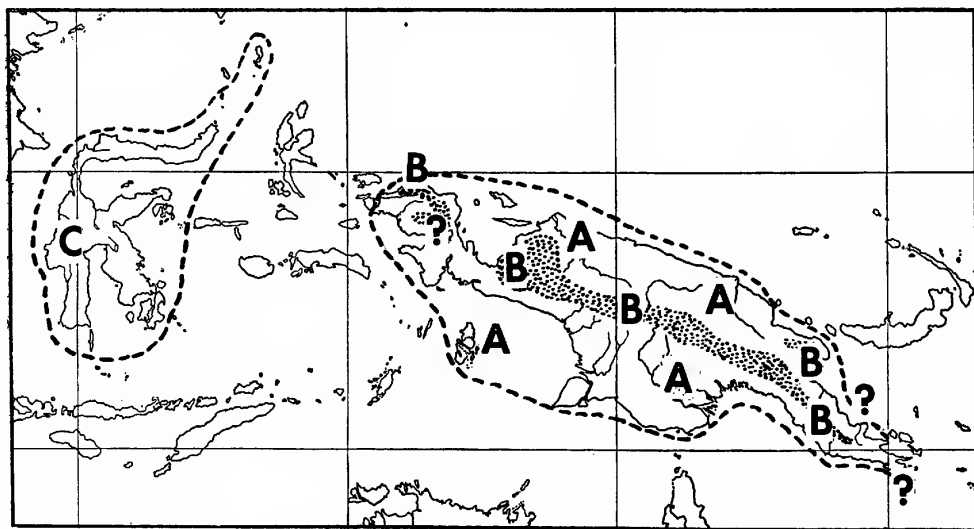


Fig. 9. Distribution pattern in the species *P. gymnotis* (A), and *P. vestitus* (B stippling) of the *P. orientalis* group, and the *P. ursinus* group (C). Due to the high altitudes preferred by *vestitus* and the low to middle altitudes at which *gymnotis* occurs, there is a minimum of overlap in these two species. The interrogation mark in Vogelkop indicates uncertainty about the presence there of *gymnotis*.

m. maculatus is known to produce white individuals of either sex. Also a single white female of *P. m. krämeri* is contained in our collection. White individuals are unknown in the *ursinus* group or in *P. celebensis*.

THE WHITE PHASE OF *P. orientalis*

Kopstein (1926), who studied phalangers during two and a half years residence in the Moluccas, found that whiteness in *P. orientalis* developed only in adult males, juvenals showing the "typical pelage of the female." Among the many pouch young

"Other Moluccan" islands investigated by him for white cuscuses were Saparua, Haruku, Buru, Ceram, Sula, and Banda. Jentink (1885, p. 96), however, quoted Valentijn (1724-1726) as saying "these white specimens always are adult males and have red eyes."

THE WHITE PHASE OF *P. m. maculatus*

White-coated animals appear in both sexes. From the appearance in stage 2 of perfectly white individuals it may be surmised either that they become white while yet in the pouch or that they develop

directly from the dark gray pouch young of early stage 1. One stage-2 male, A.M.N.H. No. 151819 from Hollandia on the coast, and two stage-2 females, A.M.N.H. No. 151804 from Idenburg and A.M.N.H. No. 109454 from Hollandia, are fully developed white forms, the male with very faint yellowish tinge, the females wholly lacking the normally present lateral line. A female without skull from the Cyclops area, of stage-2 size, shows traces of yellowish on the hair tips of feet and tail. An adult male and female from Idenburg River, both in stage 4, and a stage-5 female from Cyclops complete the series of white individuals. No trace of spots appears in any male, or of lateral line in any female. In the Idenburg adult female the base of the tail is buffy on top.

Areas of pelage in normal males and females of *P. m. maculatus* which are brown in color have their hair bases white or whitish and shorter brown hair tips. It is not thought, however, that pure white specimens represent merely the last stage of a process of color dilution. The break between pale brown forms and white forms appears to be absolute. Pure white animals may be true albinos or they may be "dominant whites." They are to be compared with white *P. orientalis*, which, however, appears to be sex-linked, being found only in males.

The white female of *krämeri* from the Admiralty Islands is unique. Several normal males and females from the same locality accompany it. Whether or not it was a true albino is not known.

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TABLE 1
SIGNIFICANT MEASUREMENTS IN *Phalanger orientalis* FROM ISLANDS WEST OF NEW GUINEA

	p ⁴ -m ⁴	L. ^a mp ⁴	W. ^b mp ⁴	L. p ⁴	W. p ⁴	L. m ¹	W. m ¹	L. m ⁴	W. m ⁴	●	Cond.- basal Length	Zyg. Width	Mast. Width	Pal. Length
Topotype of <i>P. o. orientalis</i>														
B.M. 83.3.24.7	22.7	—	—	5.1	4.0	5.0	4.1	4.2	3.8	89.5	64.3	49.0	50.5	
Old albinistic male														
"Type" of <i>P. cavifrons</i>														
Leiden M-3	—	3.9	3.2	—	—	5.1	4.0	—	—	—	—	—	—	—
Juv.														
Type of <i>P. ornatus</i>														
B. M. 60.1.10.18	21.0	—	—	5.0	4.3	5.0	3.9	3.5	3.0	77.7	49.2	41.0	43.0	
Old adult male														
Halmahera														
Genoa C.E. 10315	20.7	—	—	4.4	4.2	4.8	4.2	3.5	3.4	—	43.7	—	38.4	
Adult female														
Halmahera														
M.C.Z. 7000	24.0	—	—	5.2	4.5	5.4	4.5	4.4	3.9	—	52.0	46.0	48.0	
Adult female														
Wetar Island														
A.M.N.H. 809333	26.0	—	—	5.8	4.7	5.6	4.6	5.3	4.8	92.0	62.0	47.0	49.0	
Adult male														
A.M.N.H. 80935	25.8	—	—	5.2	4.6	5.8	4.5	5.3	4.4	91.0	57.0	49.0	49.0	
Adult female														
A.M.N.H. 80936	25.8	—	—	5.3	4.4	5.4	4.3	5.4	4.7	85.5	53.0	46.5	47.0	
Adult female														

^a Length.
^b Width.

TABLE 2

SIGNIFICANT MEASUREMENTS OF *Phalanger orientalis vulpecula* (= *interpositus* = *brevinasus* = *matsika* ?) FROM NEW GUINEA MAINLAND

	p ⁴ .m ⁴	L. mp ⁴	W. mp ⁴	L. p ⁴	W. p ⁴	L. m ¹	W. m ¹	L. m ⁴	W. m ⁴	Cond- basal Length	Zyg. Width	Mast. Width	Pal. Length	Growth Stage
Topotype of <i>P. o. interpositus</i>														
A.M.N.H. 101998	25.5	—	—	5.2	4.5	6.0	4.5	5.0	4.5	79.0	50.0	42.5	43.0	4
Adult female														
Type and paratypes of <i>brevinasus</i>														
A.M.N.H. 104100	23.9	—	—	5.0	4.0	6.0	4.5	4.4	4.0	84.0	56.0	46.0	47.0	5
A.M.N.H. 104099	25.1	—	—	5.3	4.4	5.6	4.5	4.7	3.9	79.0	48.0	42.0	44.0	4
Young adult male	24.4	—	—	4.8	4.0	5.5	4.4	4.8	3.9	84.0	54.0	43.0	47.0	4
A.M.N.H. 104148	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Adult male	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Juvenal males of <i>matsika</i>														
A.M.N.H. 104120	—	4.4	3.3	—	—	5.9	4.5	—	—	—	—	—	—	2
A.M.N.H. 104121	—	4.3	3.1	—	—	5.8	4.2	—	—	—	—	—	—	2
A.M.N.H. 108541	—	4.9	3.4	—	—	5.9	4.3	—	—	+	—	—	—	1
Cyclops Mts.														
A.M.N.H. 151818	—	4.4	2.7	—	—	5.4	3.9	—	—	—	—	—	—	2
A.M.N.H. 109653	—	4.2	3.0	—	—	5.3	4.1	—	—	—	—	—	—	2
A.M.N.H. 109432	—	4.4	2.9	—	—	5.0	3.9	—	—	—	—	—	—	2
Type and paratypes of <i>matsika</i>														
A.M.N.H. 104103	24.4	—	—	4.8	4.0	5.4	4.5	4.6	3.9	77.0	45.0	39.0	42.0	4
Young adult female	24.5	—	—	5.1	4.3	5.4	4.3	4.7	4.1	84.0	55.0	46.0	48.0	4
A.M.N.H. 108569	23.8	—	—	4.8	4.0	5.4	4.2	4.7	4.0	81.0	47.0	46.0	45.0	4
Adult female	—	—	—	—	—	—	—	—	—	—	—	—	—	—
A.M.N.H. 108570	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Adult female	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Juvenal females														
A.M.N.H. 104127	—	4.2	3.0	—	—	5.6	4.2	—	—	—	—	—	—	2
A.M.N.H. 104115	—	4.3	3.1	—	—	5.4	4.2	—	—	—	—	—	—	2
A.M.N.H. 108542	—	4.6	3.3	—	—	5.5	3.9	—	—	—	—	—	—	1
(Young of 108569)	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Idenburg R.	—	—	—	—	—	—	—	—	—	—	—	—	—	—
A.M.N.H. 151852	—	—	—	—	—	5.1	4.2	4.7	4.2	79.0	49.0	40.0	42.0	3
Young adult female	23.6	—	—	4.8	4.0	5.3	4.1	4.5	4.1	84.0	52.0	44.0	48.0	4
A.M.N.H. 109433	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Adult female	—	—	—	—	—	—	—	—	—	—	—	—	—	—
A.M.N.H. 109653	—	4.1	3.0	—	—	5.3	4.1	—	—	—	—	—	—	2
Juv. female	—	—	—	—	—	—	—	—	—	—	—	—	—	—

TABLE 3

Phalanger gymnotis (with *P. leucippus*). DENTAL MEASUREMENTS OF TYPES AND OTHER MATERIAL FROM NEW GUINEA

	p ⁴ -m ⁴	L. mp ⁴	W. mp ⁴	L. p ⁴	W. p ⁴	L. m ¹	W. m ¹	L. m ⁴	W. m ⁴	Growth Stage
<i>Type of P. gymnotis</i>										
Genoa C.E. 1545/3966	25.3	—	—	—	—	6.1	4.9	4.6	3.9	4
<i>Cotypes of P. leucippus</i>										
Genoa C.E. 10454	23.8	—	—	—	—	5.2	4.3	4.2	3.7	4
B.M. 97.8.7.88	24.5	—	—	5.8	5.2	5.8	4.4	4.4	3.5	5
<i>Virtual topotypes of leucippus</i>										
A.M.N.H. 104097	25.3	—	—	6.0	5.6	5.5	4.2	4.4	3.8	5
A.M.N.H. 104147	24.6	—	—	5.9	5.6	5.3	4.3	4.5	3.7	4
Lower Sepik R.	—	—	—	6.3	5.5	5.4	4.3	—	—	4
F.M. 31861	—	—	—	—	—	—	—	—	—	—
Upper Idenburg R.	—	—	—	—	—	—	—	—	—	—
A.M.N.H. 151846	23.6	—	—	5.1	4.6	5.4	4.6	4.5	3.9	5
A.M.N.H. 151849	—	—	—	5.7	5.6	5.4	4.5	—	—	3
A.M.N.H. 151798	24.7	—	—	5.6	5.2	5.5	4.6	4.5	4.0	5
<i>Cyclops Mts.</i>										
A.M.N.H. 109437	25.4	—	—	5.8	5.4	5.5	4.2	4.7	4.0	4
A.M.N.H. 151860	25.8	—	—	6.0	5.7	5.5	4.5	4.7	3.9	4
A.M.N.H. 109438	25.4	—	—	6.1	5.4	5.4	4.5	4.8	4.3	5
<i>Virtual topotypes of leucippus</i>										
A.M.N.H. 104098	24.5	—	—	6.0	5.5	5.4	4.3	4.5	3.8	4
A.M.N.H. 104104	—	5.2	3.8	—	—	5.6	4.6	—	—	1
Upper Idenburg R.	—	—	—	—	—	—	—	—	—	—
A.M.N.H. 151811	24.2	—	—	6.2	5.3	5.4	4.7	4.4	4.0	5
A.M.N.H. 151847	25.1	—	—	6.0	5.2	5.3	4.5	4.8	4.2	4

TABLE 4

COMPARISON OF TOOTH MEASUREMENTS OF TYPES AND PARATYPES OF THE *Phalanger vestitus* GROUP

	p ⁴ -m ⁴	L. p ⁴	W. p ⁴	L. m ¹	W. m ¹	L. m ²	W. m ²	L. m ⁴	W. m ⁴	Growth Stage
Type of <i>P. vestitus</i> Paris 1477	—	—	—	5.7	3.8	5.2	4.2	—	—	2
Juv. male										
Type of <i>P. carmelitae</i> Genoa C.E. 10455	25.5	—	—	6.1	5.0	5.6	4.3	4.6	4.6	4
Adult female										
Paratypes of <i>P. carmelitae</i> Genoa C.E. 10456	25.1	—	—	5.7	4.5	5.2	4.5	4.6	4.1	4
Adult male										
B.M. 97.8.7.87	24.8	5.0	4.4	6.1	4.8	5.4	5.0	4.4	3.9	4
Adult male										
Type of <i>P. coccygis</i> B.M. 28.10.1.17	26.5	5.0	4.3	6.2	4.8	5.9	4.8	5.0	4.3	4
Adult male										
Type of <i>P. sericeus</i> B. M. 5.11.28.23	25.1	5.0	4.3	6.1	4.3	5.9	4.5	4.5	4.5	4
Adult male										
Weyland Mts. Berlin (field No. 598)	24.6	4.6	4.2	5.9	4.5	5.4	4.8	4.3	3.9	4
Adult male										
Berlin (field No. 581)	24.8	5.0	4.2	6.0	4.6	5.6	4.8	4.4	3.9	4
Adult male										

TABLE 5

TOOTH SIZES IN *Phalanger vestitus* AND ALLIES
Series from Central Ranges near Port Moresby

	p ⁴ -m ⁴	L. mp ⁴	W. mp ⁴	L. p ⁴	W. p ⁴	L. m ¹	W. m ¹	L. m ⁴	W. m ⁴	Growth Stage
Mt. Taifa										
A.M.N.H. 104091	24.5	—	—	3.9	3.2	5.4	4.4	4.5	4.1	4
Adult male										
Wharton Range (Murray Pass)										
A.M.N.H. 104093	24.4	—	—	4.2	3.8	6.0	4.8	4.9	4.4	5
Adult male										
A.M.N.H. 104095	26.0	—	—	4.5	4.1	5.9	4.3	5.1	4.6	4
Adult male										
Mt. Taifa (<i>carnelittae</i>)										
A.M.N.H. 104110	24.1	—	—	4.5	4.5	6.0	4.5	4.5	4.3	4
Adult male										
A.M.N.H. 108563	24.5	—	—	4.3	4.5	5.6	4.5	4.8	4.2	5
Adult male										
A.M.N.H. 108565	25.4	—	—	4.6	4.5	5.9	4.2	5.0	4.2	4
Adult male										
A.M.N.H. 108567	23.5	—	—	4.6	4.5	5.3	4.4	4.6	4.1	5
Adult male										
Series from the Mt. Wilhelm Area										
A.M.N.H. 109484	23.1	—	—	4.8	4.5	5.3	4.3	4.5	3.8	5
Adult male										
A.M.N.H. 109489	24.6	—	—	5.0	4.5	5.8	4.5	5.0	3.8	4
Adult male										
A.M.N.H. 109491	23.8	—	—	4.6	4.1	5.7	4.3	4.6	3.9	4
Adult male										
A.M.N.H. 109490	23.5	—	—	4.2	3.9	5.6	4.3	4.5	4.3	5
Old adult male										
A.M.N.H. 109494	24.3	—	—	4.7	4.3	5.7	4.4	4.5	3.9	4
Adult male										
A.M.N.H. 109492	25.0	—	—	4.3	4.1	6.2	4.1	4.8	4.0	4
Adult male										
A.M.N.H. 109493	23.5	—	—	4.8	4.7	5.3	4.0	4.5	4.0	4
Adult male										
A.M.N.H. 109497	—	4.7	3.9	—	—	5.8	3.9	—	—	2
Juv. male										
A.M.N.H. 109495	23.5	—	—	5.0	4.5	5.4	4.0	4.8	4.0	4
Adult male										
A.M.N.H. 109496	24.5	—	—	4.9	4.7	5.5	4.0	4.6	3.6	4
Adult male										
Average	24.5	—	—	4.5	4.0	5.8	4.4	4.8	4.1	

TABLE 6

ANALYSIS OF JENTINCK'S (1885, PP. 112-118) DATA ON *Phalanger maculatus*

	Number of specimens			
	Male		Female	
	Young	Adult	Young	Adult
<i>Phalanger m. maculatus</i>				
Biak, Geelvink Bay	—	1	—	—
Miosnom, Geelvink Bay	—	—	—	1
Japen (Jobi, Ansus), Geelvink Bay	—	—	—	3
Mafoor (= Numfor)	—	3	—	1
Sorong, western Vogelkop	—	1	—	—
Warbusi, near Wariap, south of Manokwari	—	—	—	—
<i>Phalanger</i> with "sooty" spots in both sexes				
Waigeu	1	3	—	2
Batanta	1	—	—	—
Misol	2	1	females spotted ?	
Japen	—	1		
<i>Phalanger</i> females with black back, unspotted				
Misc	—	—	—	2
<i>Phalanger</i> with chocolate spots as in <i>chrysorrhos</i>				
Ceram	1	1	—	—
Amboina	3	5	—	—
Kei (with Khoor)	1	—	—	—
Aru	1	1	—	—
Triton (= Lobo) Bay	—	1	—	—
Saley, south of Celebes	—	—	—	—
<i>Phalanger chrysorrhos</i> (females only, with lateral line)				
Amboina	—	—	2	4
Padjang, southeast of Ceram	—	—	—	1
Andai, Vogelkop	—	—	—	1
Saley, south of Celebes	—	—	1	2
Aru	—	—	1	—
<i>Phalanger</i> females, black backed, "without lateral line," similar to our material from south New Guinea				

TABLE 7
MEASUREMENTS OF *Phalanger m. maculatus*

	No. Spec.	Total Length	Tail Length	Hind Foot Length	Cond.-basal Length	Zygomatic Breadth	Growth Stage
Cyclops Mts. and Hollandia	3 ♂	(660-741) 700	(320-382) 350	(55-71) 63	(66-80) 73	(42-52) 48	2
	1 ♂	1140	570	87 ^a	102	70	4
	1 ♂	1108	520	80 ^a	107	75	5
	1 ♀	538	271	48	60	37	1
	6 ♀	(628-777) 700	(320-395) 355	(57-64) 60	(66-76) 71	(42-48) 45	2
	4 ♀	(1160-1204) 1180	(550-595) 575	(83-90) 86	(105-108) 106	(67-73) 70	4
	1 ♀	1250	605	95	107	78	5
	1 ♂	545	264	52	— ^b	— ^b	1
	1 ♂	—	—	—	68	51 ^c	2
	6 ♂	(753-775) 765	(355-358) 357	(62-66) 64	(79-87) 83	(46-64) 50	3
Upper Idenburg R.	3 ♂	(950-980) 965	(445-455) 450	(75-81) 78	(94-96) 96	(63-69) 66	4
	1 ♂	995	455	78	96	67	5
	1 ♀ ^d	624	290	54	— ^b	— ^b	1
	2 ♀	(611-672) 641	(285-320) 302	(53-59) 56	(65-67) 66	42	2
	2 ♀	850	395	71	(87-88) 96	(55-56) 61	3
	1 ♀	—	—	—	(98-102) 100	(65-67) 66	4
	5 ♀	(1057-1105) 1080	(470-505) 480	(75-85) 80	—	—	5

^a The skins of these two males appear to have had the labels exchanged.

^b Skull broken.

^c No skins.

^d Dentition slightly advanced beyond normal of group.

TABLE 8

MEASUREMENTS OF *Phalanger m. chrysorrhos* FROM SOUTH NEW GUINEA

No. Spec.	Total Length	Tail Length	Hind Foot Length	Cond.-basal Length	Zygomatic Breadth	Growth Stage
2 ♂	(390-452) 420	(180-225) 205	(40-42) 41	52.5	(32-32.5) 32	1
2 ♂	(640-755) 700	(290-352) 320	(50-64) 57	(65-77) 71	(42-48) 45	2
5 ♂	(740-860) 800	(360-401) 380	(63-72) 67	(82-89) 85	(51-53) 52	3
5 ♂	(945-1010) 960	(450-493) 470	(70-81) 76	(93-101) 97	(61-67) 64	4
5 ♂	(1040-1350) 1190	(490-510) 500	(80-90) 85	(100-105) 102	(67-74) 70	5
1 ♀	348	155	33	47.5	30	1
4 ♀	(570-648) 610	(272-309) 290	(47-60) 53	(61-70) 65	(39-45) 42	2
1 ♀	920	425	76	90	54	3
5 ♀	(970-1030) 1000	(445-490) 465	(73-81) 77	(96-102) 99	(62-65) 63	4
5 ♀	(950-1070) 1010	(430-485) 460	(73-77) 75	(96-105) 100	(61-67) 64	5

TABLE 9

DIMENSIONS OF *Phalanger m. nudicaudatus*

[illegible]

^a Compare with stage-4 males of *chrysorrhos*.

TABLE 10

DENTAL MEASUREMENTS IN *Phalanger ursinus* AND ALLIES

	p ⁴ -m ⁴	i ³	L. mp ⁴	W. mp ⁴	L. p ⁴	W. p ⁴	L. m ¹	W. m ¹	L. m ⁴	W. m ⁴	Cond.- basal Length	Zyg. Width	Growth Stage
Cotypes of <i>P. ursinus</i>													
Leiden a	—	—	—	—	6.0	4.4	7.0	5.5	—	—	105.0	67.0	5
Old adult male													
Leiden b	—	—	—	—	6.3	5.1	7.0	5.3	—	—	86.0	56.0	3
Young adult ?													
Leiden c	—	—	—	—	5.7	4.6	7.4	5.3	—	—	—	—	3
Juvenal ?													
B.M. 44.3.2.2													
Young female													
(former Leiden cotype)	—	3.0	—	—	—	—	—	—	—	—	—	—	4
Also from N. Celebes													
Buitenzorg 2802	32.0	3.1	—	—	5.9	5.1	7.1	5.6	5.5	4.9	98.0	67.5	4
Young adult male													
Buitenzorg 2741	32.5	3.0	—	—	6.3	5.4	7.0	5.6	5.2	4.7	91.0	55.5	4
Young adult female													
Buitenzorg 2800	32.0	2.7	—	—	6.0	4.9	7.1	5.3	5.3	4.8	98.0	64.0	4
Young adult female													
Buitenzorg 2803	32.0	2.8	—	—	6.0	5.2	7.0	5.5	5.7	4.9	95.0	62.0	4
Young adult female													
A.M.N.H. 152884	30.0	3.1	—	—	5.8	4.6	6.7	5.3	5.0	4.7	96.0	66.0	4
Young adult female													
Peleng Islands													
A.M.N.H. 10894	30.4	3.2	—	—	5.5	4.8	7.2	5.2	4.9	4.2	92.0	59.0	4
Young adult male													
A.M.N.H. 109233	30.5	2.8	—	—	5.6	4.7	7.0	5.2	5.4	4.5	87.5	54.5	4
Young adult male													
A.M.N.H. 108791	—	3.0	—	—	5.5	4.5	7.0	5.2	—	—	80.0	49.5	3
Juvenal male													
A.M.N.H. 108801	—	2.7	4.4	3.2	—	—	7.0	5.5	—	—	72.0	44.0	2
Juvenal male													
A.M.N.H. 108769	30.7	2.7	—	—	5.7	4.7	7.3	5.4	5.4	4.6	93.5	59.0	4
Adult female													

TABLE 10 (Continued)

	p ⁴ -m ⁴	i ³	L. mp ⁴	W. mp ⁴	L. p ⁴	W. p ⁴	L. m ¹	W. m ¹	L. m ⁴	W. m ⁴	Cond.- basal Length	Zyg. Width	Growth Stage
A.M.N.H. 108800													
Juvenal female	—	2.9	4.2	3.0	—	—	7.2	5.3	—	—	72.0	45.0	2
A.M.N.H. 108795													
Juvenal female	—	2.8	4.9	3.4	—	—	7.3	5.4	—	—	75.5	46.0	2
Type of <i>P. furvus</i>													
Adult male	34.2	—	—	—	—	—	—	—	—	—	101.5	66.2	5
Also from Middle Celebes													
Buitenzorg 2568													
Young adult male	31.8	3.9	—	—	6.3	5.4	7.2	5.7	5.6	5.2	91.0	59.0	4
South Celebes													
A.M.N.H. 100981													
Adult female	31.8	3.6	—	—	6.4	5.4	7.4	5.9	5.6	5.2	102.0	69.8	4
A.M.N.H. 100982													
Adult female	33.8	4.0	—	—	6.4	5.7	7.6	5.9	6.2	5.4	104.0	68.0	4
Type of <i>P. togianus</i>													
A.M.N.H. 153377													
Young adult male	31.0	3.9	—	—	6.2	5.0	6.7	5.7	5.5	4.7	93.0	62.0	4
Paratypes <i>togianus</i>													
A.M.N.H. 153381													
Young adult male	30.5	3.8	—	—	6.0	5.1	6.5	5.2	5.8	4.6	96.0	59.0	4
A.M.N.H. 153374													
Young adult male	30.5	3.7	—	—	5.9	5.3	6.8	5.7	5.4	4.4	91.0	59.0	4
A.M.N.H. 153370													
Young male	30.7	3.8	—	—	6.2	5.2	7.0	5.2	5.3	4.8	88.0	57.0	4
A.M.N.H. 153371													
Young male	30.7	4.1	—	—	5.8	5.4	7.0	5.5	5.4	4.4	87.0	55.5	4
A.M.N.H. 153365													
Adult male	30.5	3.7	—	—	6.4	5.2	6.7	5.4	5.7	4.8	99.0	63.0	4
A.M.N.H. 153359													
Adult male	30.7	3.9	—	—	6.8	5.6	—	—	5.4	4.7	97.0	62.0	4
A.M.N.H. 153375													
Adult female	31.2	3.4	—	—	6.1	5.3	7.1	6.2	5.7	4.9	96.0	62.5	4
A.M.N.H. 153373													
Young adult female	31.0	3.4	—	—	6.2	5.7	7.0	5.7	5.8	4.9	94.0	62.5	4

